Particle Instruments

Aerosol Instrument Manager® Software for Aerodynamic Particle Sizer® (APS™) Spectrometers

User's Manual

P/N 1930064, Revision E
April 2006

TSI®

Aerosol Instrument Manager® Software for Aerodynamic Particle Sizer® (APS™) Spectrometers

User's Manual

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Manual History

The following is a manual history of the Aerosol Instrument Manager Software for Aerodynamic Particle Sizer® (APS™) Spectrometers User's Manual (Part Number 1930064).

Revision	Date
First Version	December 2001
A	May 2002
B	October 2002
C	April 2005
D	October 2005
E	April 2006

Warranty

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About This Manual

Purpose

This is a user's manual for the Aerosol Instrument Manager® Software as it applies to an Aerodynamic Particle Sizer® (APS™) Spectrometer.

Related Product Literature

- *Model 3321 Aerodynamic Particle Sizer® (APS™) Spectrometer manual* (part number 1930092), TSI Incorporated
- *Model 390069 Data Merge Software Module manual* (part number 1930074), TSI Incorporated

Getting Help

To obtain assistance for this software or to submit suggestions, please contact Particle Instruments:

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CHAPTER 1

Introduction

The Aerosol Instrument Manager® software is used to collect sample data from a TSI instrument and store the sample data in files. You can use the software to display data in graphs and tables, or view statistical information. You can print graphs and tables with the software, and you can also export data for use in other applications.

There are a number of ways to navigate within the program. These include selecting items from the main menus, selecting icons from the toolbar, and selecting items from submenus (which you access by right-clicking the mouse button). Specific instructions are provided in the following chapters.

The Aerosol Instrument Manager software is designed to be used with a variety of different TSI spectrometers.

- Aerodynamic Particle Sizer® (APS™) Spectrometers
- Scanning Mobility Particle Sizer™ (SMPS™) Spectrometers
- Condensation Particle Counters (CPCs)
- Electrical Aerosol Detectors (EADs)
- Aerosol Electrometers

This manual covers the use of the Aerosol Instrument Manager software with TSI APS spectrometers only. For information about software operation with other TSI spectrometers, refer to the appropriate manual.

This manual assumes you have Microsoft® Windows® (Windows 2000 or Windows XP) on your computer and that you are familiar with how Windows works. If you are not familiar with Windows, please refer to the information that came with it before you load and use this program.

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How This Manual is Organized

This manual describes the Aerosol Instrument Manager software and includes information such as:

- Requirements for loading and running the software.
- The installation procedure that loads the program onto your computer.
- A "Getting Started" chapter that introduces basic software operations.
- "How to ..." information for using the program to operate and collect data with a specific spectrometer.
- Descriptions of the menus and menu items that are valid when collecting data with an APS or viewing data files from an APS.
- Appendixes that provide reference information associated with program operation.

Notations/Conventions Used in This Manual

- Throughout this manual when reference is made to "Windows," it implies Windows® 2000 or Windows® XP operating system.
- Bold face type is used to indicate that you should perform the indicated action. For example "select the **File** menu" means that you should use the mouse and click on the menu called File.
- When instructions direct you to select items from a menu, a vertical bar (|) is used to separate the items you should select. For example, "select **File|Properties|Scheduling**" means you should click on the File menu, then select the Properties item, and then select the Scheduling tab.
- The term "active window" is used to refer to the window that is open on the desktop and is in focus. To verify which window is active, select the **Window** menu and note which item has a checkmark by it. You can make a window active by moving the pointer to that window and clicking the mouse button.

CHAPTER 2

Installing the Software

This chapter describes the installation requirements for the Aerosol Instrument Manager® software and the installation procedure.

Note: *If the Data Merge software is being used with the Aerosol Instrument Manager® software, it should be installed as listed:*

```
C:\Program Files\tsi\Data Merge Software
Module\DataMerge.exe
```

When installed correctly, Aerosol Instrument Manager activates the data merge software and the Data Merge icon appears (*) on the main toolbar. For more information on the Data Merge software, please refer to the Model 390069 Data Merge Software Module manual (P/N 1930074).*

Installation Requirements

To use this software we recommend a personal computer with the following minimum features, components, and software:

- A Pentium® 586 processor or higher.
- A SVGA color monitor.
- Microsoft Windows® 2000 or Windows® XP operating system.
- A hard drive large enough to accommodate Windows, the Aerosol Instrument Manager software, and data files.

  Note*: The amount of disk space required depends on the number of samples you collect, the amount of information collected, and the sampling period. After you have collected a number of samples, you may want to look at the file size to estimate how much storage space you will be using.*
- A CD-ROM drive.
- 256 MB or more of random access memory (RAM).

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- A mouse.
- An RS-232 serial interface port for each instrument connected (in addition to the one that may be required for the mouse).
- A Microsoft Windows-compatible printer is optional.

Installation

Install the Aerosol Instrument Manager software as follows:

1. Shut down (exit) all programs/applications on the Windows desktop.
2. With the computer on and Windows running, insert the Aerosol Instrument Manager CD-ROM in your CD drive to run the **autorun.exe** from the CD.
   a. If AutoPlay is enabled on your PC, the setup program will begin automatically and the introduction screen will be displayed on the Windows desktop.
   b. If AutoPlay is not enabled, select **Run** from the **Start** menu and type: `D:\autorun` (where D is the letter corresponding to your CD drive) in the Open box and press **OK**.
3. Follow the instructions as the setup program runs. When setup is complete, you should read the readme.htm file. You should view the readme.htm file if one is available. This file contains important information that could not be included in this manual. If you decide not to read the file immediately, you can access the file later. It will be installed in the same directory as the application.
4. When the installation program finishes, remove the CD-ROM and store the CD in a safe place for later use.

The setup program creates a directory (folder) called “Aerosol Instrument Manager” on your hard disk (assuming you accepted the default directory name). The directory contains the required program files and sample data files.

The setup program also creates a new item in the Start Menu called “TSI” and an icon for the Aerosol Instrument Manager.

***Note**: Before creating a TSI menu item, the setup program checks for an existing one. If one is present, it adds the icon only.*

CHAPTER 3

Getting Started

This chapter is designed to give you an introduction to the basic operation of the Aerosol Instrument Manager® software. Using it, you will:

- Start the program.
- Open an existing file (from the example files provided with the program).
- Change how data is viewed.
- View another sample in the same file.
- Playback (review) data samples in a “slide show” fashion.
- Select a data hot spot.
- Delete/Undelete samples.
- Zoom in and zoom out on data in a graph.
- Print information displayed on the desktop.
- Export data to a file.
- Arrange open windows.
- Quit the program.

Start the Program

To start the program, proceed as follows:

From the Windows desktop, using the mouse, double-click the Aerosol Instrument Manager icon or press the **Start** menu and select **All Programs | TSI | Aerosol Instrument Manager.**

The Aerosol Instrument Manager desktop appears as shown in Figure 3-1.

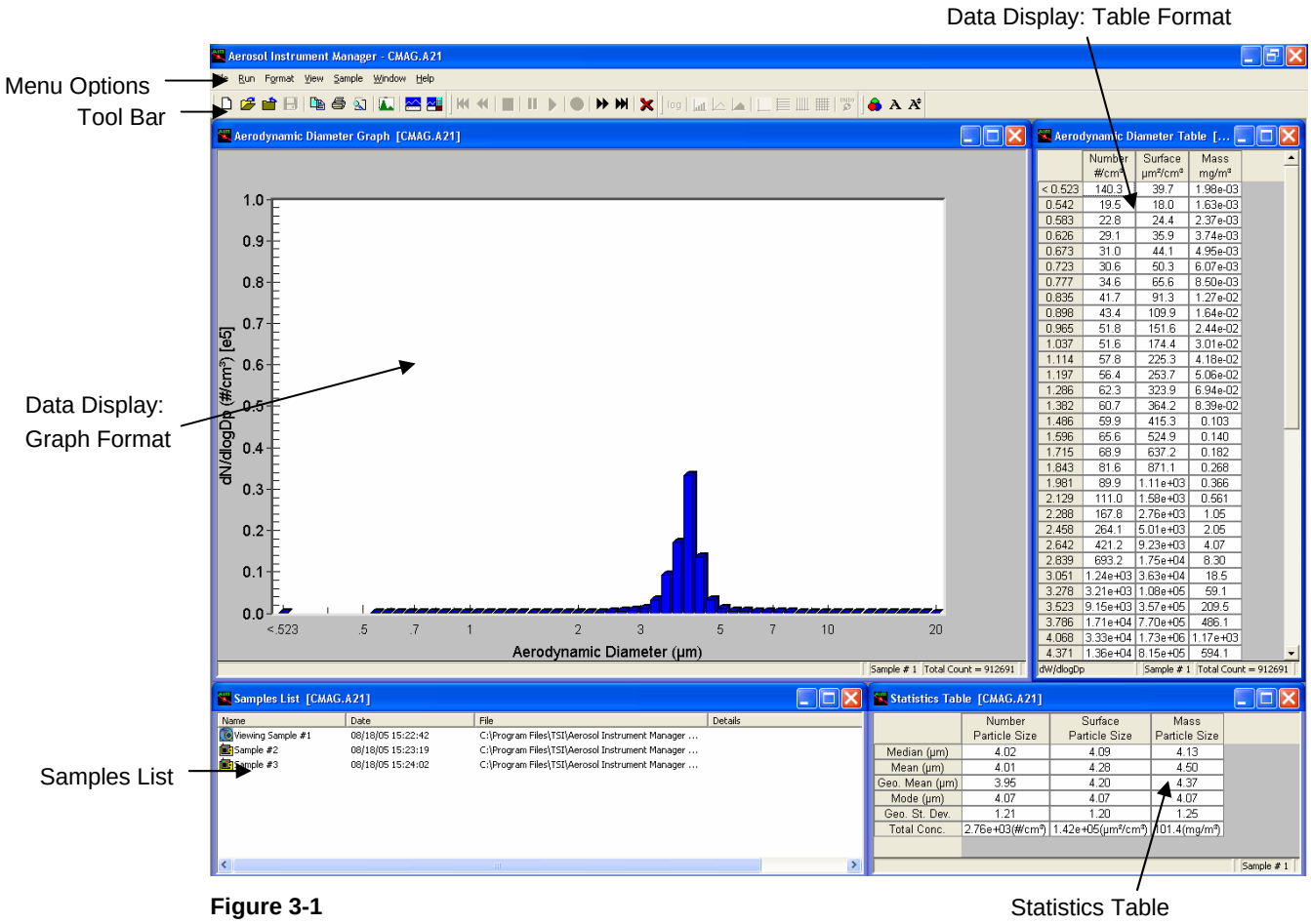

Figure 3-1
The Aerosol Instrument Manager Desktop and Selected Displays

Open an Existing File

1. Select **File | Open** or on the toolbar. The "Open Instrument Associated Data Files" window opens.
2. When the "Open Instrument Associated Data Files" window appears, select the correct extension for the file you want to open in the "Files of type" box. For an APS, the file extension is *.Axx*, where *xx* indicates the APS model.
3. If necessary, browse for the drive/directory where data files are stored. (Example files are included with the program and were installed in the Aerosol Instrument Manager folder when the program was installed.)
4. Select the data file that you want to open and click **Open**. At least two windows open on the desktop: a window containing a graph of the sample data, and the Samples List window.

Note: *If the file has been opened before, it may display more than one graph and/or table. The program remembers the windows that were open on the desktop when you last closed the file and reopens them when you access the file again. If the file contains a sequence of samples, you will be asked if you want to open all the files or just the one you originally chose. See Appendix E for information about sequence files.*

The Samples List window opens whenever you open a data file and remains open on the desktop as long as the data file is open. Closing the Samples List window closes the data file (and all its open windows).

Change How Data is Viewed

You can view APS data in tables or graphs and in several different formats (for example, data can be viewed by counts, concentration, etc.). The following procedure provides an example of how you can change how data is viewed.

1. Open one of the sample APS files as described in "Open an Existing File".
2. With the graph window active on the desktop, open the **View** menu.
3. Use the mouse to select **View | Weight | Mass**. Notice the change in how data is displayed. (A checkmark next to one of the menu items means that a window for that selection is already open on the desktop. If you select a menu item that is already checked, the window containing that graph or table is brought to the top of the desktop and becomes the active window.)
4. Experiment with other views by making other windows active and selecting other options from the **View** menu to see how your selections change the data.

View Another Sample in the Same File

1. To view another sample in an open file, select the icon (go forward one sample) from the toolbar. The data for the next sample of the currently active file replaces the data in all the open windows.
2. You can continue to step through the samples by pressing the icon until you reach the last sample.

The sample currently displayed in the open window is highlighted in the Samples List window.

Another method of changing the sample that is displayed in the open window on the desktop is by selecting the icon for that sample from the active Samples List window.

You can use the following icons to display other samples:

First Sample. Advance to the first sample.

Previous Sample. Advance to the previous sample.

Next Sample. Advance to the next sample.

Last Sample. Advance to the last sample.

Playback (Review) Data Samples

You can display sample graphs and tables in a slide show fashion (to preview sample results or compare sample differences) as follows:

1. From the Samples List window, select the samples you want to play back using one of the following actions:

   Select **Sample | Select All,** to play back all samples.

   or

   Select individual samples using the mouse and the Ctrl key to highlight those samples you want to see. (You must select at least two samples.)

   or

   Select a group of samples by holding down the left mouse button and moving the mouse to “rubber band” (outline) the samples you want to select.

   Note: *The Playback menu items and toolbar icons are only enabled when the Samples view is the active view.*

2. When you have selected the samples you want to view, select **Playback | Play**. The setup box shown in Figure 3-2 appears.

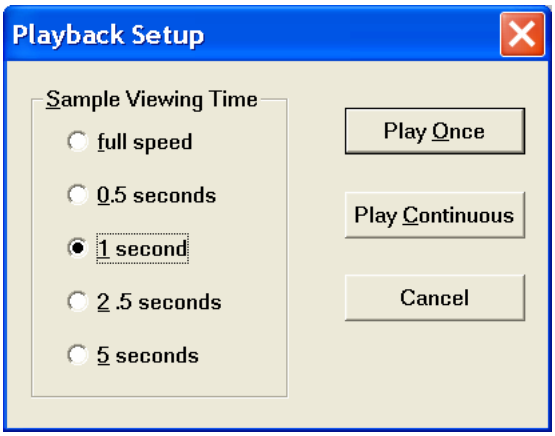

Figure 3-2
Playback Setup Dialog Box

3. Select the sample viewing time and whether you want the samples displayed once or continuously. Playback begins immediately. For better viewing, it may be necessary to minimize the Samples List window.

4. You can pause the playback at any time by selecting **Playback | Pause**. Select **Playback | Play** to continue playback where you left off. You can stop playback at any time by selecting **Playback | Stop**. When you stop playback, you cannot restart it. Use **Playback | Pause** and **Playback | Play** if you want to stop and start playback.

You can also control playback by using icons on the toolbar. The icons perform the following operations:

Stop. Stop playback.

Pause. Pause playback on current sample.

Start. Start playback or restart playback.

Select a Data Hot Spot

When a graph is open on the desktop, you can find the values of a data point as follows:

1. Position the pointer on the bar, line, or peak (depending on the type of graph that is active). The pointer becomes a pointing hand.

2. Press the left mouse button to display the values. Figure 3-3, shows how the data values are displayed for an APS spectrometer (diameter and number concentration).

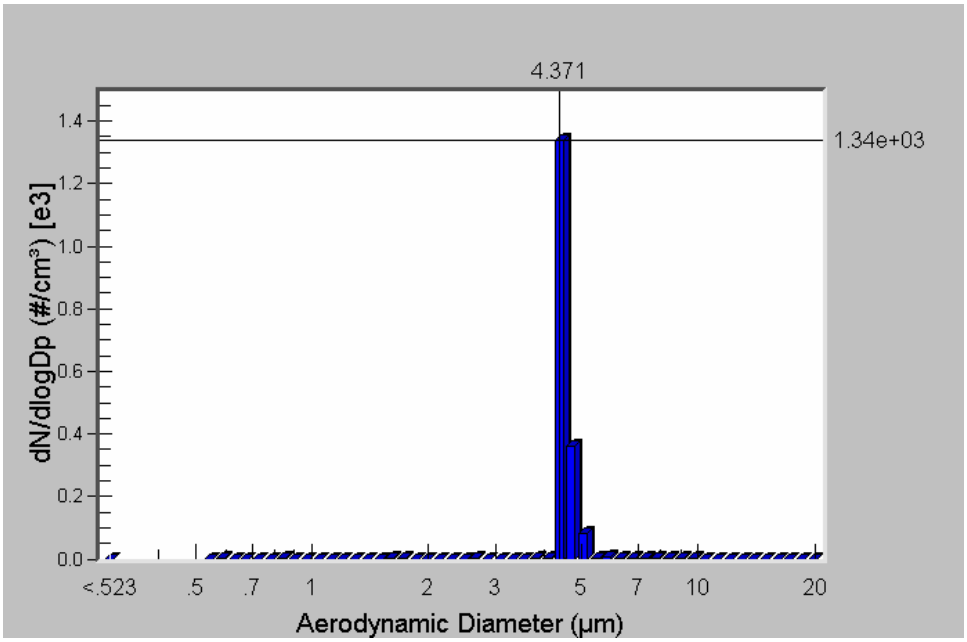

Figure 3-3
Use the Mouse to Directly View Data Values

Tip: *After you have a data hot spot selected, use the arrow keys or the ">" and "<" keys to move the cursor right or left (from one value to the next), or grab the vertical bar and drag it to another location. Refer to Appendix B for a list of other keys or key combinations you can use to navigate and perform operations without using the mouse.*

Delete/Undelete Samples

To delete samples from a file, you must first mark them for deletion and then either **Close** or **Save** the file. The following procedures will permanently delete samples from a file:

Mark samples for deletion as follows:

1. Select the sample you want to delete from the Samples List window (you can select multiple samples).
2. Select **Sample | Delete/Undelete Sample** or on the toolbar. The samples will be shown as "Deleted." However, they will not be permanently removed from the file until you **Close** or **Save** the file.

Save the file and permanently delete all samples marked for deletion:

1. With at least one sample marked for deletion in the active file, select **File | Save**. You will get a message stating: "Some samples have been marked for deletion. Do you want them permanently removed?" Click **Yes** to remove them or **No** to keep them.
2. Select **Yes**. The samples marked for deletion are permanently deleted.

Note: *If you attempt to close all the windows for the file or exit the program without saving the file, you will get a message asking whether you want to save changes to the file. Respond **Yes** and you will get the same message stating "Some samples have been marked for deletion. Do you want them permanently removed?" Respond **Yes** to delete the marked samples and **No** to close the file without deleting them.*

Zoom In and Out on Data in a Graph

You can zoom in on data displayed in a graph as follows:

1. Use the mouse to position the cursor (pointer) at one corner of the area you want enlarged.
2. Press down on the left mouse button and drag the mouse to the opposite corner of the data you want enlarged.
3. Release the left mouse button. The area you selected is enlarged.
4. You can continue to zoom further by repeating steps 1 through 3.

To Unzoom, select **Format | Undo Zoom** or

on the toolbar. The enlarged area is returned to normal view.

Print Information Displayed on the Desktop

You can print the information displayed in the active window on the desktop as follows (you must have a printer properly installed):

1. With a graph or table window active on the desktop, select **File | Print Preview** or .
2. Review that what you see in the print preview window is what you want to print (an example is shown in Figure 3-4), and then

select **Print** from the Preview box. The contents of the window are sent to your printer.

You can immediately print a window without previewing it by selecting **File | Print** or from the toolbar.

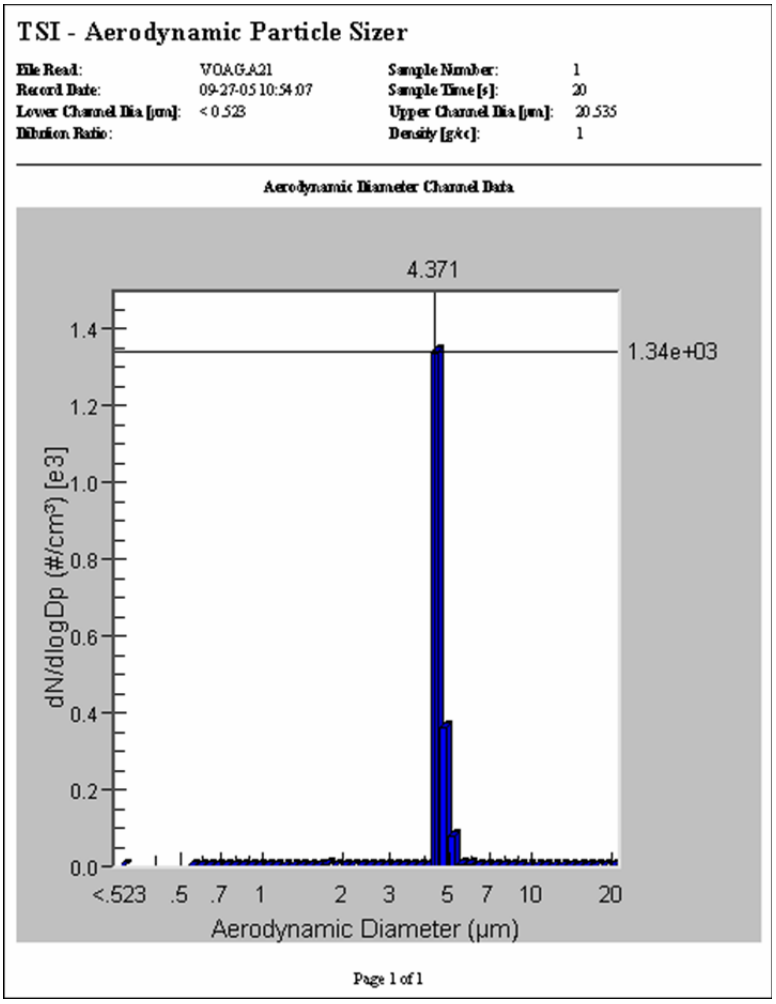

Figure 3-4
Print Preview

Export Data to a File

You can export data from an APS Aerosol Instrument Manager file in two ways: manually or automatically.

Manually Export Data to a File

To manually export data (either a single sample of the file or multiple samples of the file) for use in another program (such as Microsoft Excel®):

1. Select the sample or samples to be exported as follows:

   To export data from a single sample, display the sample data in an active window on the desktop.

   To export data from multiple samples, select (highlight) the samples you want to export from the Samples List window.

2. Select **File | Export**. An Export Parameters box appears.

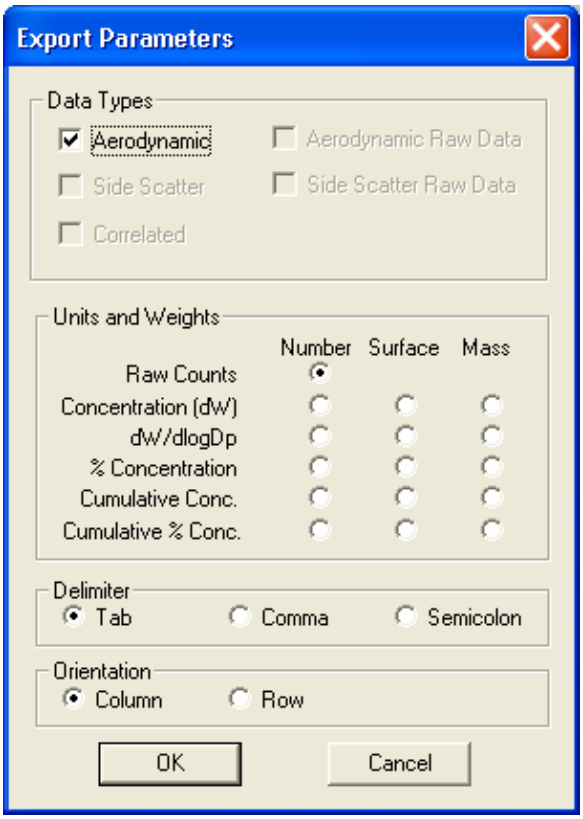

Figure 3-5
The Export Parameters Box.

3. Select the type of data you want to export as well as the format you want to export the data in.

   Data can be exported in a delimited text file and you can select

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from three delimiters: tab, comma, or semicolon. The orientation of data can be either column or row.

4. After selecting the export parameters, press **OK**.
5. Select the drive/directory you want to export the data to and enter a filename. The system automatically adds the .txt file extension.
6. Press **Save**.
7. Figure 3-6 illustrates how an exported *.txt file is formatted for an APS Spectrometer.

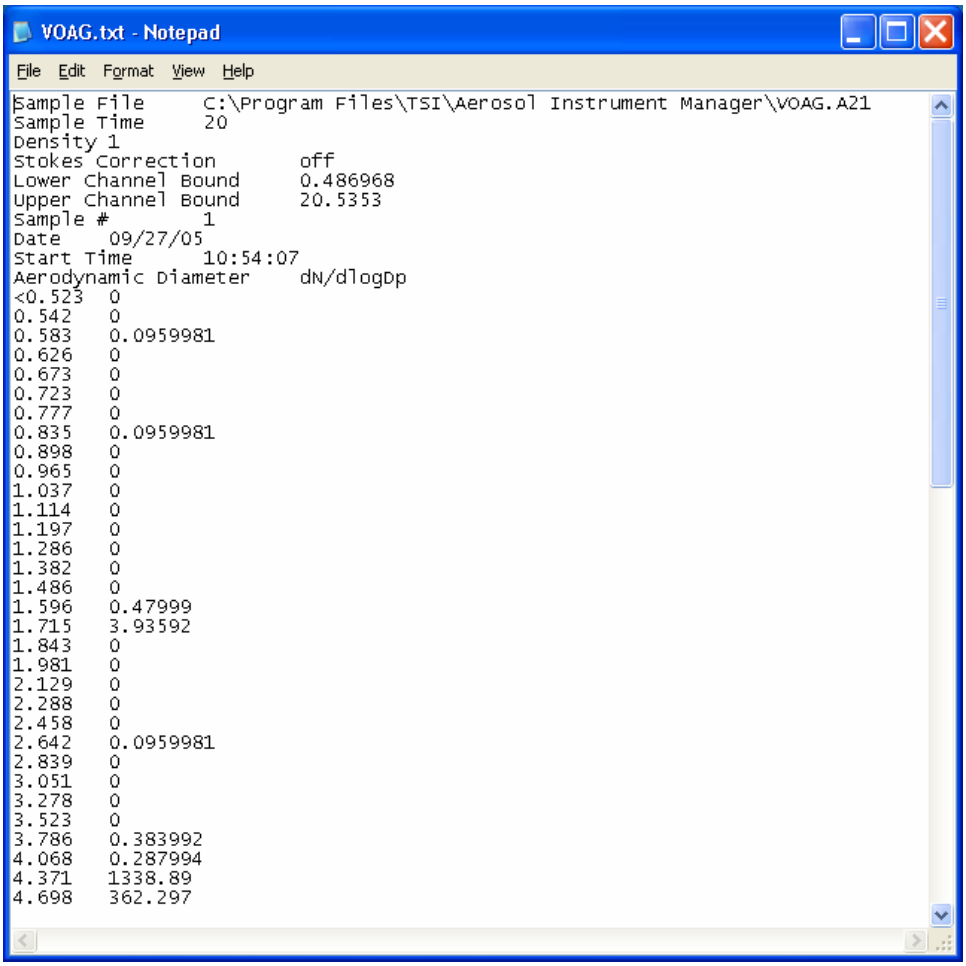


Figure 3-6
A Sample Export File

Automatically Export Data to a File

To export data automatically to a file for use in another program (such as Microsoft Excel):

1. Establish a connection to the APS spectrometer by choosing **File | New**, or **File | New** followed by **Run | Connect to the APS**.

2. Select **Run | Auto Export** before you begin to collect data. Select the type of data you want to export as well as the format you want to export the data in, using the Export Parameters dialog box (see Figure 3-6). Data will be exported as it is collected.

3. Select **Run | Start Data Collection.** The data is exported to the file as it is collected.

Arrange Open Windows

When you have several windows open on the desktop it is helpful to arrange them for easier viewing.

To arrange windows, select an item from the **Window** menu. You can arrange windows on your desktop horizontally, vertically, have them cascade, or arrange them in a predetermined auto-fit layouts. Refer to your Windows documentation for examples and more information for tile horizontal, tile vertical, and cascade layouts. Press the button (or **Ctrl+L**) in the toolbar for the four-pane layout or press the button (or **Ctrl+K**) for the two-pane layout as shown in Figure 3-7 for a spectrometer file.

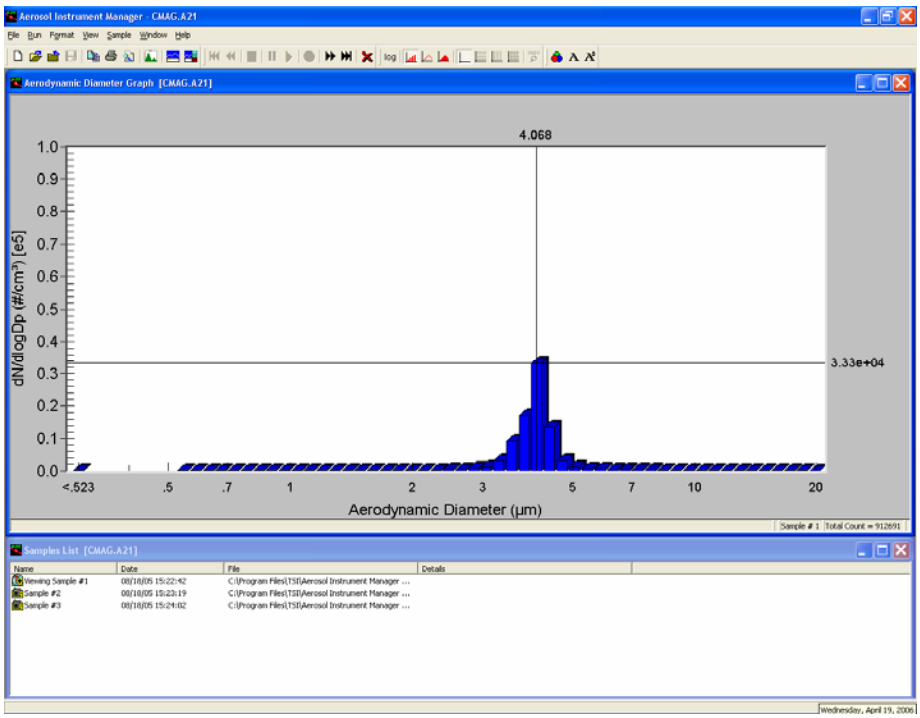


Figure 3-7
Two-Pane Layout of an APS File

All of the program windows that are currently open on the desktop are listed at the bottom of the **Window** menu under the **Close All**

item. To make a window active and bring it to the top of all windows, select the name of the window from the list of open windows.

Quit the Program

To end the program, select **File | Exit**. All windows and files open on the desktop are closed. If you have made changes to a file and have not yet saved it, you will be prompted to do so.

CHAPTER 4

Software Procedures

Before using the information in this chapter, read Chapter 3. That chapter provides getting started information to help you understand the basics of how the program works.

The subsections of this chapter provide:

- "How To..." information for: collecting sample data with an APS, setting up properties for an APS, changing the 3D graph type (APS 3320, APS 3321 and UV-APS only), and rotating a 3D graph (APS 3320, APS 3321 and UV-APS only).
- A description of all menus and menu items available when using the APS or viewing APS data files.

How To Collect Sample Data

There are three steps for collecting sample data from an APS.

- Step A: Open a new APS file
- Step B: Review/change parameters
- Step C: Start data collection

Note: *You can append APS sample data to an existing file. Refer to "Append Sample Data to an Existing APS File" below.*

Before you begin, make certain you have connected the TSI spectrometer to the computer and the instrument is running. Refer to the appropriate hardware instruction manual if necessary.

Step A: Open a New APS File

Select **File | New** or on the toolbar. The **New Instrument and Associated Data Files** dialog box (Figure 4-1) opens on your desktop.

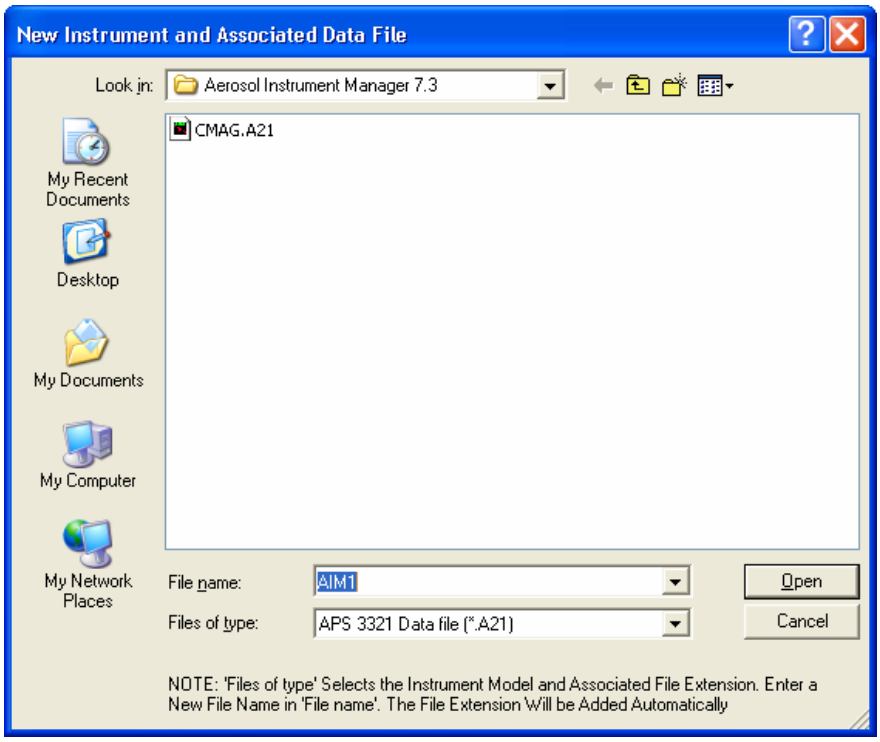

New Instrument and Associated Data File
Look in:
Aerosol Instrument Manager 7.3
CMAG.A21
My Recent Documents
Desktop
My Documents
My Computer
My Network Places
File name:
AIM1
Files of type:
APS 3321 Data file (*.A21)
Open
Cancel
NOTE: 'Files of type' Selects the Instrument Model and Associated File Extension. Enter a New File Name in 'File name'. The File Extension Will be Added Automatically

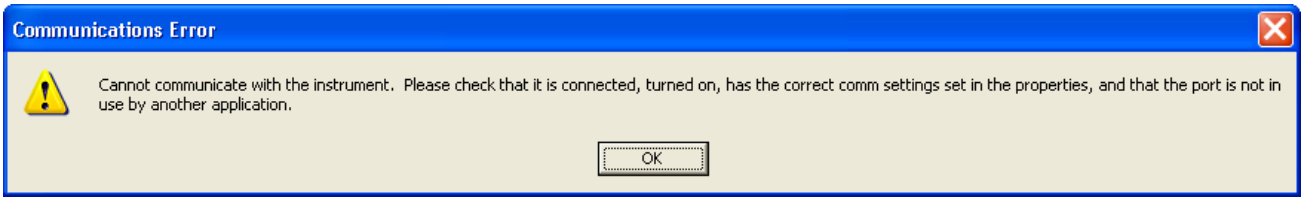
Figure 4-1
Select an APS Filename When you Open a New File

Before you can begin collecting data, you must select a filename (and, optionally, a location other than the Aerosol Instrument Manager folder). The default name will be “AIM1” for the first file you open, “AIM2” for the second file you open and so on. You can accept the default name or enter any name you choose.

Important: Verify that the “Files of Type” box indicates the correct extension for the spectrometer you are using (.A10, .A12, .A20 or .A21). You do not need to enter an extension in the file name box. It will be assigned automatically.

After you enter a filename (or if you accept the default name) press the **Open** button.

If you get the following error message when opening a New file, press the **OK** button. This will open the Properties dialog box.


Communications Error
Cannot communicate with the instrument. Please check that it is connected, turned on, has the correct comm settings set in the properties, and that the port is not in use by another application.
OK

Verify the connection to the spectrometer and make certain the spectrometer is turned on. To verify the Com Port setting:

1. Check that the correct communications port was selected during program setup by clicking on the Test button.
2. If the test is unsuccessful, select another port and press the Test button again.

   Note: *Most computers have only two active communications ports, COM1 and COM2. COM1 maybe used to connect the serial mouse, so COM2 is most likely available for the TSI spectrometer connection.*

3. Once the test is okay, select **OK** to return to the desktop and the active window.

Step B: Review/Change/Set Up Spectrometer Properties

Before you begin sampling, you may want to review the Properties dialog to verify things such as correct start time, data settings, and so on.

To view the properties dialog, select **File | Properties** or **Run | Properties** (or **Ctrl+R**) and select the various tabs to review each setting. Refer to "How To Set Up Properties for an APS Spectrometer" later in this chapter.

Once you have set up the parameters, or verified they are correct, close the Properties dialog box and continue with step 3.

Step C: Start Data Collection

After you have completed the properties dialog, data collection begins at the "Start At Time" you set on the Properties dialog or immediately after you do one of the following:

- Select **Run | Start Data Collection** from the menu.
- Click on the toolbar.
- Double-click the New Sample icon in the Samples List window.

When the program begins collecting sample data, the data is displayed in the windows that are open on the desktop.

Note: *When you start collecting APS data with the computer, the display menu of the APS 3320 or APS 3321 spectrometer is disabled. This prevents inadvertent changes to the properties you have set for sampling.*

As each sample finishes, the data for the sample is stored and a new sample begins. When the last sample finishes, sampling stops, but the windows remain open.

To stop data collection before all the samples are collected, do one of the following:

- Select **Run | Finish Current Sample**. Data collection stops after the current sample finishes.

  or

- Select **Run | Abort Current Sample** or on the toolbar to stop data collection immediately. When you select **Abort Current Sample**, the data collected for the current incomplete sample is discarded.

How To Set Up Properties for an APS Spectrometer

With an APS data file active on the desktop, access the Properties dialog box by selecting **File | Properties** or **Run | Properties** (or **Ctrl+R**).

Note: *An APS window must be active on the Aerosol Instrument Manager desktop to access the APS Properties menu item.*

The properties displayed in the Properties dialog box are either:

- The initial default properties as set by TSI or
- The default properties set by a user who selected **File | Save Properties as Default** after making changes to the Properties dialog box.

Note: *If you want to use the same settings the next time you access the properties dialog, remember to select* ***File | Save Properties as Default*** *after you have completed the Properties dialog.*

The Properties dialog box contains four tabs: Data Settings, Scheduling, Data Types, and Communications. Each is described below. Their content differs slightly for each APS model.

The following paragraphs describe the settings for each tab of the Properties dialog box.

APS Data Settings Tab

The Data Settings tab lets you specify parameters that are applied to the data when you view or export it. The actual data in the file is not affected by these parameters.

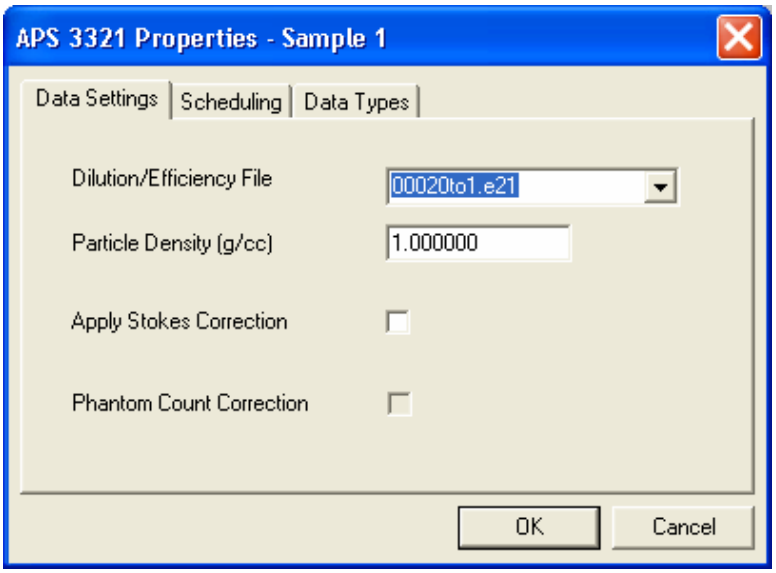


Figure 4-2
Data Settings Tab of the Properties Dialog Box

Table 4-1
Descriptions of the Data Setting Parameters for an APS Spectrometer

Setting	Description
Dilution/ Efficiency File	Use this list box to select an efficiency file that you want to use to condition sample data. This efficiency file is automatically loaded and used in calculating sample data. The file must be located in the folder created during program setup where the software is installed (usually Aerosol Instrument Manager folder). The file must also have an extension of ".e*xx*" where *xx* reflects the instrument the file is used with. (For example, 00001to1.e21 is an efficiency file for the 3321 APS, 00001to1.e20 is an efficiency file for the 3320 APS, 00001to1.e10 is an efficiency file for the 3310 APS.) The dilution files provided with the software are for use with TSI 3302A Diluter(s). **Spectrometer:** All APS
Particle Density (g/cc)	Enter the particle density (in g/cc) you want the software to use when calculating the surface area and mass concentrations. The default is 1.000000. (The geometric diameter is calculated first and then the surface area and mass are derived, assuming spherical particles). If you enter a value other than 1.000000, you are changing the Y axis on the graphs; the shape of the distribution remains the same. **Spectrometer:** All APS
Apply Stokes Correction	Check this box if you want Stokes correction to be applied to the aerodynamic diameter data. (applying this correction improves the accuracy of particle sizing for particles with a density <0.9 and >1.1.) Stokes correction is described in Appendix D. The view boundaries may change when Stokes correction is applied. If the density is >1.1, the maximum size is less than 20.535. The view boundary will move to the new maximum size if the current upper boundary is larger than the Stokes adjusted maximum size. Likewise, the lower view boundary will change when the density is <0.9 and the selected view boundary is less than the Stokes corrected minimum size. **Spectrometer:** All APS

Setting	Description
Phantom Count Correction	Check this box if you want Phantom Count correction to be applied to the aerodynamic diameter data. ***Note:*** *Phantom counts can be created by the small particle processor of the APS 3310 or APS 3310A. When only one pulse is detected per particle, a pulse generated by another particle can cause a randomly sized particle to be recorded. Particles in the range of 5.2 to 15.4 µm are measured by both the large and small particle processors. Phantom count correction estimates the number of phantom particles by calculating the difference between the number of counts detected by each processor within the overlapping size channels. This difference is subtracted from each channel of data in the small particle processor.* **Spectrometer:** APS 3310, APS 3310A

APS Scheduling Tab

The Scheduling tab lets you select the number of samples, the length of each sample, how often samples are collected, and the start time for the sample. You cannot change the sample length for a file that already has data. If you want to change the sample length, you must start a new file. Figure 4-3 shows an example Properties dialog box showing the Scheduling tab. A description of each parameter follows.

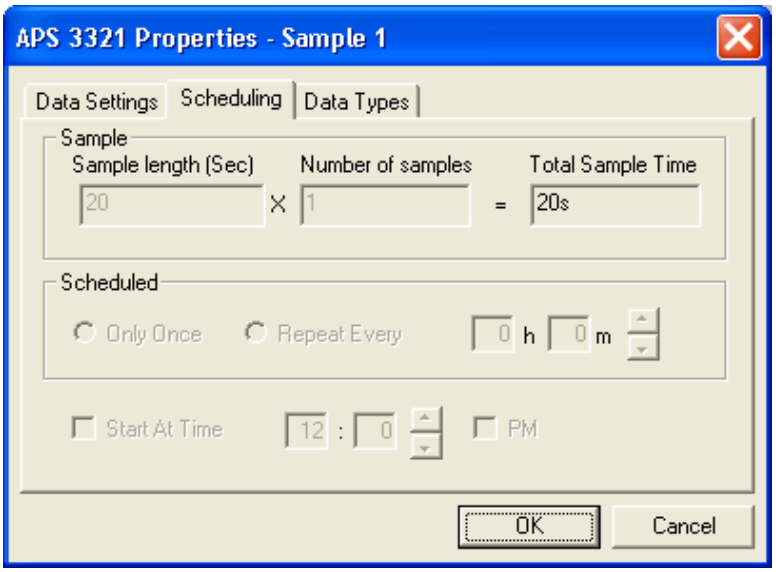


Figure 4-3
Scheduling Tab of the Properties Dialog Box for the APS 3321

Table 4-2
Descriptions of Scheduling Parameters for an APS Spectrometer

Parameter	Description
Sample length (Sec)	This is the amount of time (in seconds) that data will be collected from the TSI spectrometer for each sample. The maximum value allowed is 65535 (18 hours, 12 min., 15 sec.).
Number of Samples	This is the total number of samples you want to collect. The maximum value allowed is 65535.
Total Sample Time	This field is calculated by the software and shows the total sample time based on the values you entered in the Sample Length and Number of Samples boxes. The value is displayed in hours, minutes, and seconds.
Scheduled	Select only once to collect one set of samples. For continuous monitoring, select **Repeat Every** and then select the hours and minutes between samples. The intersample time should be longer than the Total Sample Time to include the overhead time that is needed for file handling.
Synchronize Sample Timing	If this box is checked, the value in the Sample length box is the elapsed time of the sample. In this mode, Aerosol Instrument Manager calculates the APS 3310's sample length based upon known timing overhead for this instrument. If this box is unchecked, the value in the Sample length box is used as the sample length. If this box is checked, the elapsed time for a sample will include overhead. ***Note:*** *The typical elapsed time for the APS 3310 to complete a single sample takes an additional 8% of the time set in Sample Length field of the properties dialog box. For example, a sample length of 60 seconds would take 65 seconds to complete.* **Spectrometer:** APS 3310
Start At Time	If you don't check this box, sampling begins as soon as you select **Start Data Collection**. If you want to select a start time, check the box and enter the clock time at which you want sampling to begin. The program uses a 12-hour or 24-hour clock, depending on how your PC is set up. If your PC is set up to use a 12-hour clock, you must indicate if the time is am or pm by unchecking or checking the PM box. The reference time for the program is the time at which your computer is set.

Files of Sample Sessions That Run Past Midnight

The files for sample sessions that run past midnight are handled differently than those that start and stop on the same date. In this case a sequence of files is created, with each file in the sequence given a unique filename extension identifying its proper order. Appendix E provides a complete description of sequence files including how to access a file that is part of a sequence.

APS Data Types Tab

The Data Types tab lets you set up the type of data to be collected. The type of data that can be collected varies depending on which TSI spectrometer you are using.

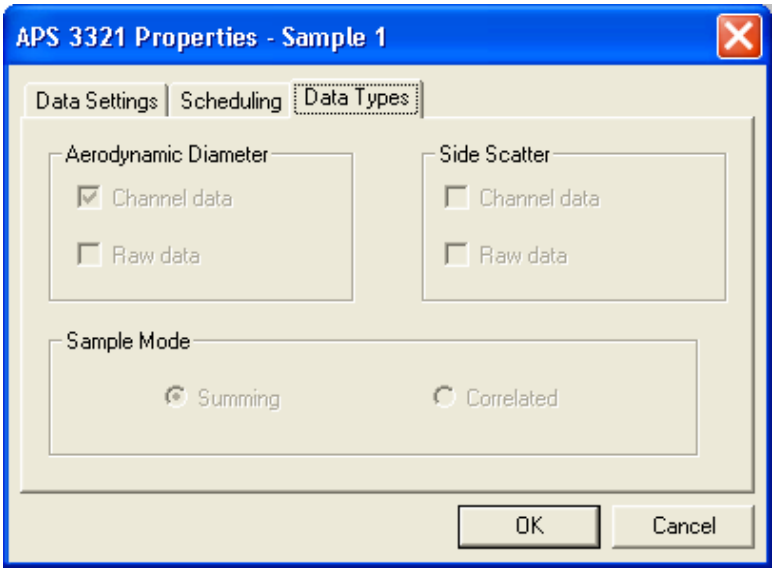


Figure 4-4
Data Types Tab of the Properties Dialog Box for an APS 3321

Table 4-3
Descriptions of Data Types Parameters for an APS Spectrometer

Type	Description
Aerodynamic Diameter	Select the data you want collected. You can collect channel data*, raw data** or both. **Spectrometer:** APS 3310 APS 3310A APS 3320 APS 3321 UV-APS. *The APS 3310 will always collect channel data. **The UV-APS will not collect raw data.

Type	Description
Side Scatter	You can have the program display channel data, raw data* or both. **Spectrometer:** APS 3320, APS 3321 and UV-APS *The UV-APS will not collect raw data.
Sample Mode	Select the sampling mode you want to use: Summing or Correlated. You may only select one. Correlated mode does not collect raw data. Correlated mode collects Side Scatter vs. Aerodynamic Diameter data. When correlated mode is selected, it is recommended to use 38400 baud rate in the APS to transfer data. The data display updates once every second in Summing mode and once every four seconds in Correlated mode. The number concentrations measured by the 3321 APS are the same in summing mode and in correlated mode for all size channels except for channel No. 1 which includes particles smaller than 0.523 μm. In the Aerosol Instrument Manager software, the number concentration in channel No. 1 (< 0.523 μm) in summing mode includes event 1s, thus is always higher than that in correlated mode which doesn't include event 1s. In the display on the front panel of the instrument, the number concentrations in channel No. 1 are the same in summing mode and in correlated mode because they both include event 1s. **Spectrometer:** APS 3320 and APS 3321
Side Scatter vs. Aerodynamic Diameter	Collect Side Scatter vs. Aerodynamic Diameter correlated data. **Spectrometer**: UV-APS only
Fluorescence vs. Aerodynamic Diameter	Collect Fluorescence vs. Aerodynamic Diameter correlated data. **Spectrometer**: UV-APS only
Fluorescence vs. Side Scatter	Collect Fluorescence vs. Side Scatter correlated data. **Spectrometer**: UV-APS only
Resolution	Determines the resolution of the sample data for Fluorescence and Side Scatter measurements. Choose from 2, 4, 8, 16, 32, 64 divisions. **Spectrometer:** UV-APS only

APS Communications Tab

The Communications tab, Figure 4-5, lets you set up and test the communications port and is only available when you open a new file. The parameters of the communications tab are identical for all spectrometers.

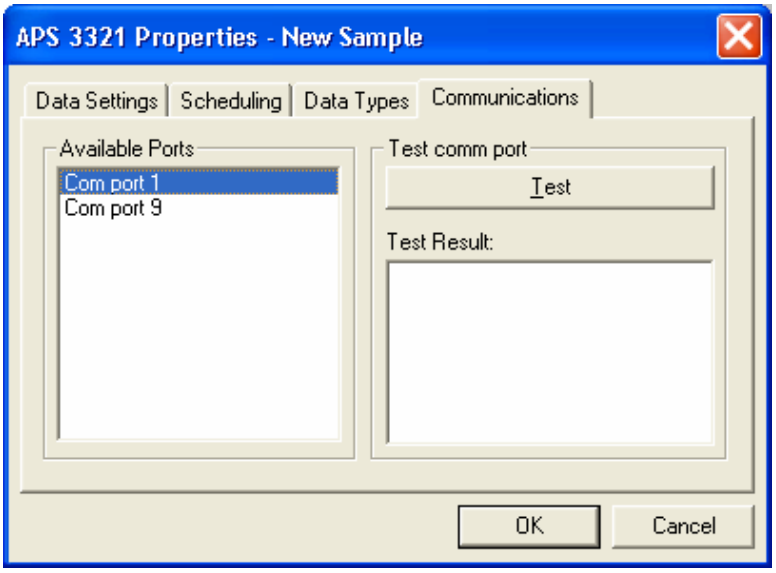
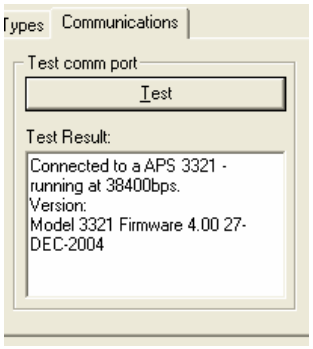


Figure 4-5
The Communications Tab of the APS Properties Dialog Box

Table 4-4
Descriptions of Communications Parameters for an APS Spectrometer

Property	Description
Available Ports	Lists the ports available on your computer system and lets you select the port that is connected to the TSI spectrometer.
Test Button	After you select a Com Port, press this button and the software will try to read data from the spectrometer to verify that you have selected the correct port and have a working connection.
Test Results	Reports the results of the test whether it is connected or not. 

Append Sample Data to an Existing APS File

To append sample data to an existing APS file:

1. Open the file that you want to append data to.
2. Select **Run | Connect to the APS**.

If a connection is not found, the Properties dialog opens with the Communications tab selected to let you establish a connection with the APS spectrometer.

Once there is a valid connection, the New Sample icon appears in the Samples List window and the Start Data Collection button is enabled on the toolbar. You can then append samples to the data file (see Step C: Start Data Collection, above).

How To Change the 3D Graph Type (APS 3320, APS 3321 and UV-APS only)

You can change the 3D graph type by selecting **Format | Graph Type** from the menu bar. Figure 4-6 shows the graph type dialog box. Pick a graph type which best represents your data.

Note: *A window with a 3D graph must be active on the desktop to change the graph type. Refer to the descriptions of the View menu later in this chapter.*

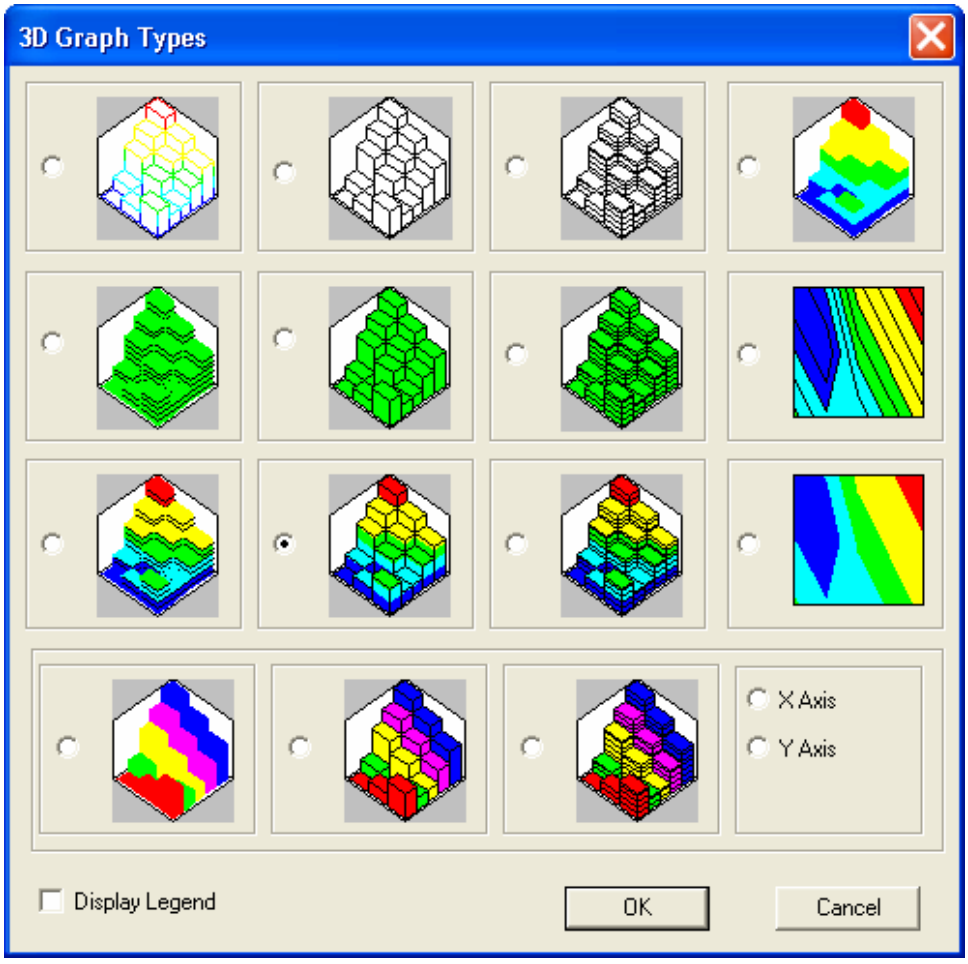


Figure 4-6
The 3D Graph Type Box for a UV-APS Spectrometer

The last row of graph types will highlight either rows or columns, alternating colors. Select which axis you want the colors applied to.

Tip: *The rendering performance varies based upon the graph type you select. Pick a graph type that provides acceptable rendering performance.*

How To Rotate a 3D Graph (APS 3320, APS 3321 and UV-APS only)

To rotate a 3D graph, you can either:

- Hold down both mouse buttons and move the mouse to rotate the graph. As you move the mouse, the graph is redrawn. While in the rotate mode, you can select one axis to rotate by pressing **x**, **y**, or **z**, and then move the mouse perpendicular to the axis.

Tip: *The 3D graphs take a lot of CPU processing to render the image. If you have experienced poor performance while rotating the graph using the mouse, then make sure the "Enable Rotation Preview" check box is not checked. With the check box cleared, you will only be shown a wire frame of the 3D plot cube.*

- Use the 3D graph rotation dialog box shown in Figure 4-7. This dialog box allows you to enter the x, y, z rotation of the 3D graph.

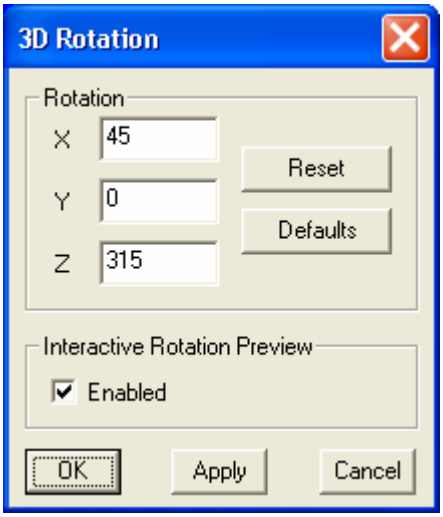


Figure 4-7
The 3D Rotation Box

Table 4-5
Descriptions of 3D Rotation Box Parameters

Parameter	Description
X, Y, Z	Shows the current rotation of the 3D graph in degrees. By clicking on these edit boxes, you are able to specify a rotation view.
Reset	Resets the X, Y, Z parameters back to their original values when you entered this dialog box.
Defaults	Sets the X, Y and Z values to the default view.
Interactive Rotation Preview	When this box is checked, you can interactively see the 3D graph while rotating it using the mouse method described above. When this box is not checked, you will only see a wire frame while rotating the 3D graph. ***Note:*** *If you experience poor performance while rotating a graph when this box is checked, use the wire frame method for rotating the graph.*

Active Menus for an APS Spectrometer

This section describes the various functions available for an APS through the menus on the Aerosol Instrument Manager desktop. The Menus include: File, Run, Playback, Format, View, Sample, Window, and Help.

Which menus are available depends on the operation you are currently performing on the desktop.

In addition to the menus, a toolbar (located just beneath the desktop menus) is available to provide shortcuts to many of the functions in the menus. You can hide the toolbar if you want to enlarge the desktop, see the description of the View Menu, below.

Note: *All menus and the menu items are described below. Depending on the operation you are currently performing and the window that is active on the desktop, the menu may appear different than shown, i.e., some menu items may not be available.*

File Menu

The items of the File menu are used to open, save, and recall files and perform other program operations.

Figure 4-8
File Menu for an APS Spectrometer

New

Select **File | New** or on the toolbar to open a new file and prepare to collect sample data.

After you select **New**, you are prompted to enter a filename. Accept the default filename or enter any filename you chose, then select **OK**.

A Samples List window and a graph window open on the desktop with the filename you entered and you are ready to start collecting data. Refer to "How To Collect Sample Data" for a complete description.

Open

Select **File | Open** or on the toolbar to open an existing file. By default, sample files are stored in the same directory as the Aerosol Instrument Manager program. All files will automatically be given the appropriate filename extension according to the spectrometer model you are using (see above description). If you store data files in another directory or on another drive, you must first display the file pathname in the Open window before you can select and open it.

Note: *When opening files for sample sessions that run past midnight, refer to the description of Sequence Files in Appendix E and for information on how the files are opened.*

When the file opens, a window opens on the Aerosol Instrument Manager desktop containing data from the first sample in the file.

You can have many samples and many files open on the desktop at the same time. Only one window, however, is the active window.

Close

Select **File | Close** to close a file (and all the windows associated with it). If windows are open on the desktop from more than one file, **Close** will close only those windows associated with the file whose window is currently active. If you attempt to close a file that has been changed but not saved, you will be prompted to save the changes before closing the file.

If you have marked a sample or samples for deletion, but have not saved the file, you will get the following message: “Some samples have been marked for deletion. Do you want them permanently removed?” If you click **Yes** the sample files marked for deletion are permanently deleted. If you click **No** the samples marked for deletion are not deleted. They are saved, and are no longer marked for deletion.

Save

Select **File | Save** or on the toolbar to save sample data to a file.

If you have marked a sample or samples for deletion, but have not saved the file, you will get the following message: “Some samples have been marked for deletion. Do you want them permanently removed?” If you click **Yes** the sample files marked for deletion are permanently deleted. If you click **No** the samples marked for deletion are not deleted. They are saved, and are no longer marked for deletion.

Save As

Select **File | Save As** to save data in an existing file to a new filename. (The file contents are duplicated to the new filename. If you want to delete the original filename, use Windows Explorer to do so.)

After you select **Save As**, you can select a drive/directory. You can use the same filename if you save the file to another

drive/directory, but if you want to save the file to the same directory, you must give it a new name.

Do *not* add the filename extension. It is added automatically when you select **Save**.

Import (APS 3310 only)

Select **File | Import** to import data into the program from previous versions of the software. For example, to import a file from the APS 3310, navigate to the directory that contains the 3310 file and select the file you want to import.

Export

Select **File | Export** to export data (either a single sample or multiple samples of a file) for use in another program. Data is exported in a delimited text file. Refer to "Export Data to a File" in Chapter 3 for information.

Properties...

Select **File | Properties** to set the parameters used by the Aerosol Instrument Manager software to collect sample data. The Properties dialog box has four tabs. The parameters that can be set for each spectrometer on each tab are described in "How To Collect Sample Data" earlier in this chapter.

Save Properties As Default

Select **File | Save Properties as Default** if you want the properties for the currently selected sample to be the default properties for new samples.

Set to Original Defaults

Select **File | Set to Original Defaults** if you want to return all setting in the Properties dialog box to the original settings as provided by TSI.

Print

Select **File | Print** to print the active window on the desktop. If you want to preview the output before printing it, select **File | Print Preview**.

Refer to your Windows documentation for information about the Print dialog box.

Print Preview

To avoid printing something you don't want, select **File | Print Preview** to see what your printed output, Figure 4-9, will look like before selecting **Print**.

Print Setup

Select **File | Print Setup** to set up the printer for printing. Refer to your Windows documentation and your printer's documentation for information about setting the printer parameters.

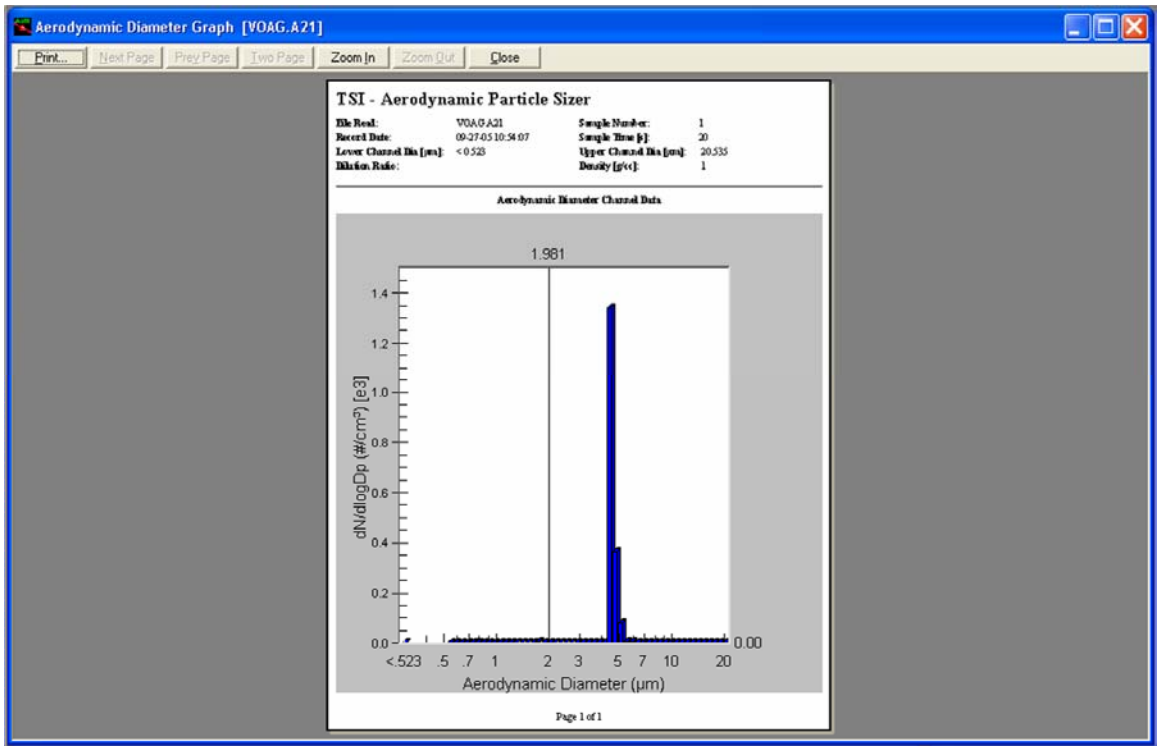


Figure 4-9
Print Preview Lets You See What Will be Printed Before You Print it

List of Recently Accessed Files

Between the Printer Setup and Exit menu items is a list of the most recently accessed data files (a maximum of four files is displayed). These are accessed from the menu by selecting **File | 1**, **2**, **3**, or **4**.

The list provides a shortcut to these files so you can bypass the Open command. To open one of the files listed, use the mouse to highlight it and then click the left mouse button. The file opens on the desktop.

Exit

Select **File | Exit** to end the program.

Run Menu

The items available under the Run menu are used to start and stop data collection.

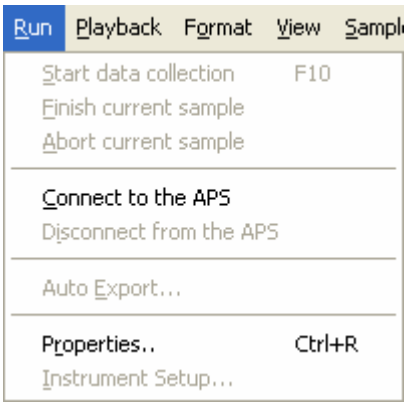


Figure 4-10
Run Menu for the APS Spectrometer

Start Data Collection

With a new file open on the desktop, select **Run | Start Data Collection** or on the toolbar to begin collecting sample data. Samples are collected according to the sample length, number of samples, scheduled times and other parameters set in the tabs of the Properties dialog (see earlier in this chapter).

Note: *If a start time is set, this menu item (and its associated icon) is disabled.*

Once you select **Start Data Collection**, sampling begins immediately. As data is collected, it is displayed in the open windows.

Finish Current Sample

Select **Run | Finish Current Sample** when you want to stop collecting sample data prematurely (Before the sampling period ends as set in the Properties dialog.). When you select this item, the current sample is allowed to finish before sampling ends.

Abort Current Sample

Select **Run | Abort Current Sample** or from the toolbar when you want to stop collecting sample data immediately. When you select this item, sampling stops and the data for the current sample is discarded.

Connect to the APS

Select **Run | Connect to the APS** if you want to connect an open data file to append more samples to the file. If a connection is not found, the Properties dialog opens with the Communications tab selected to let you establish a connection with the APS.

Once there is a valid connection, the New Sample icon appears in the Samples List window and the Start Data Collection button is enabled on the toolbar. You can then append samples to the data file.

Disconnect from the APS

Select **Run | Disconnect from the APS** to disconnect an open file and stop collecting samples. You cannot append samples to a file unless it is connected to the APS spectrometer. Once the APS is disconnected, the New Sample icon is removed from the Samples List window and the Start Data Collection button is disabled.

Auto Export

Select **Run | Auto Export** to automatically export the data as it is collected to a file. When you select this menu item, an Export Dialog box opens. Select the type of data you want to automatically export, then press **OK**.

Note: *You cannot auto-export raw data or export data in columns.*

See "Export Data to a File" in Chapter 3.

Properties...

This menu item provides a shortcut to the same Properties menu item listed under the File menu and appears here for convenience.

Select **Run | Properties** to display the Properties dialog that lets you set the parameters used by the Aerosol Instrument Manager software to collect sample data.

The parameters that can be set are described earlier in this chapter.

Instrument Setup... (APS 3320 and APS 3321 only)

Select **Run | Instrument Setup** to bring up a dialog box that allows you to change instrument settings.

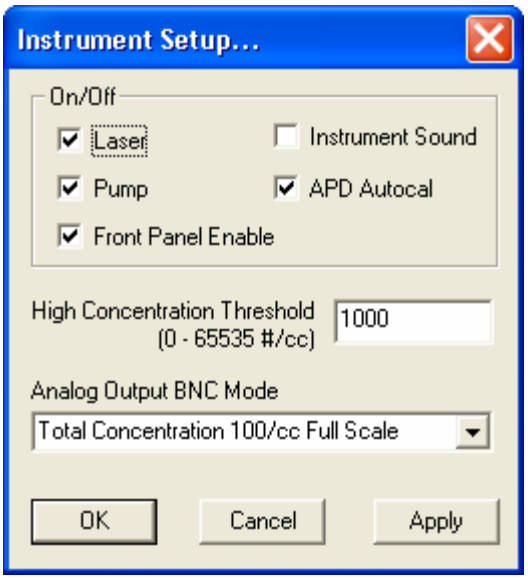


Figure 4-11
Instrument Setup

Table 4-6 provides an explanation of each field in the Instrument Setup dialog box.

Table 4-6
Setup Fields for the APS 3320 and APS 3321

Setup Parameter	Description
Laser	Turn the laser on and off.
Pump	Turn the pumps on and off.
Front Panel Enable	Enable or disable the instrument front panel display.
Instrument Sound	Turn on and off the beeping sound that is activated when the High Concentration limit is exceeded
APD Autocal	Enables the Avalanche Photodetector (APD) temperature compensation algorithm when set to On. When set to Off, the APD voltage will not change with the APD temperature. This setting will always be enabled when the instrument is first powered on.
High Concentration Threshold	The limit of the number of particles per cc. The range is from 0 – 65535. When this limit is exceeded, a status flag will be set, the LED on the instrument will light up, and the instrument will beep if the sound is set to On.
Analog Output BNC Mode	Sets the mode and range for the analog output BNC on the back panel of the APS. For a more detailed description, refer to the *Model 3320 or 3321 Aerodynamic Particle Sizer* instrument manual.

Playback Menu

The Playback menu appears only when a Sample List window is active on the desktop. Its purpose is to allow you to display graphic and table windows in series, like a slide show, so that you can compare samples or view a series of samples.

Figure 4-12
Playback Menu

Refer to "Playback (Review) Data Samples" in Chapter 3 for instructions.

Play

Select **Playback | Play** or from the toolbar to display the control window for playing the samples you selected. First select the time you want each sample displayed (full speed, 0.5, 1.0. 2.5 or 5.0 seconds). Then select whether to view the samples once or continuously. As soon as you select **Play Once** or **Play Continuously** the open views for the first sample you selected are displayed for the specified period, then the views for the second sample are displayed, and so on until all the samples selected have been displayed. If you selected **Play Continuous** from the Playback Setup dialog box, the series repeats itself indefinitely.

Pause

Select **Playback | Pause** or from the toolbar to interrupt the playback of the samples. This feature lets you stop playback to view the data of an interesting sample without canceling the playback of all selected samples. When you want to start playback again, select **Playback | Play**.

Stop

Select **Playback | Stop** or from the toolbar to end sample playback before all samples have been displayed. If you select Stop and you want to restart sampling, you must select **Playback | Play**, select the time you want each sample displayed, select play once or continuously, and begin displaying samples from the first selected sample.

Format Menu

The Format menu has many variations depending on the active window. The menu items of the Format menu let you control how information is presented in tables and graphs including: graph type, grid lines, font, color, etc. When a Sample List window is active on the desktop, the menu items of the Format menu let you determine how items in the Sample List window are displayed. You can select large or small icons, or list the samples with or without details. Details include: date, pathname, and title of the sample.

When a window is active on the desktop, you can display the Format menu items (plus other menu items) by placing the cursor in the window and clicking the right mouse button.

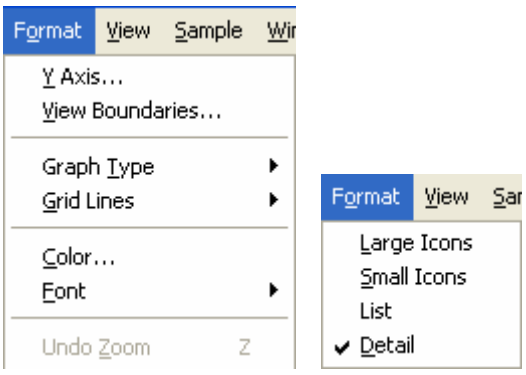


Figure 4-13
Format Menu for an APS File (A) When a Graph Window is Active, (B) When a Samples List Window is Active

Y Axis

This menu item is available only when a graph window is active on the desktop.

Select **Format | Y Axis** to select the way the Y axis is displayed, see Figure 4-14. By default, the graphs display in normal/auto scale. You can select Auto or Fixed scale and either log or normal scale. To display in logarithmic scale, check the **Log Scale** box.

If you select **Fixed Scale**, you must enter a minimum and/or maximum number (you do not need to enter both).

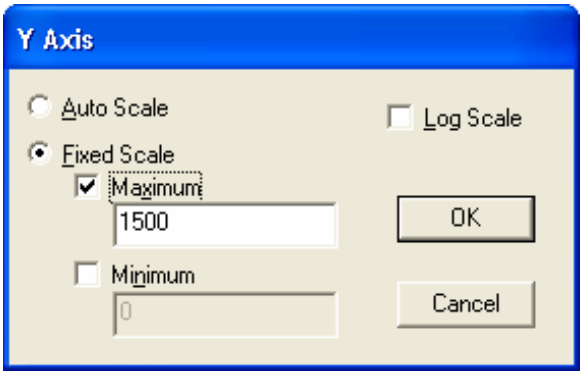


Figure 4-14
The Y-Axis Dialog Box

View Boundaries

Select **Format | View Boundaries** to display the View Boundaries dialog box, as shown below. Use the dropdown boxes to select the upper and lower boundaries of the data's size range that will be viewed. Data is displayed between the selected boundaries and statistics are computed based on the range of data between the boundaries. Select **Set to Mx View** to include all data.

In the graph window, you can drag view boundaries by positioning the cursor on the boundary you want to change, clicking the left mouse button, and dragging the view boundary to the new location.

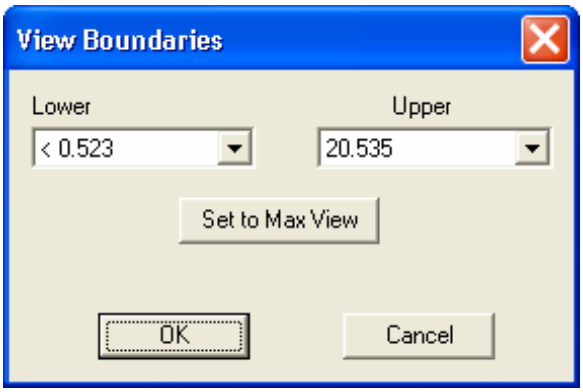


Figure 4-15
View Boundaries Dialog Box

Graph Type (2D)

Select **Format | Graph Type** to select the type of graph to display in the active window. The options are bar, line, or area. If the Graph toolbar is visible, you can select the option using the appropriate icon.

Display graphs using bars.

Display graphs using lines.

Display graphs showing area.

Grid Lines

Select **Format | Grid Lines** to select the lines for the graph in the active window. The options are horizontal, vertical, both or none. If the Graph toolbar is visible, you can select the option using the appropriate icon.

Display graphs with no grid.

Display graphs with a horizontal grid.

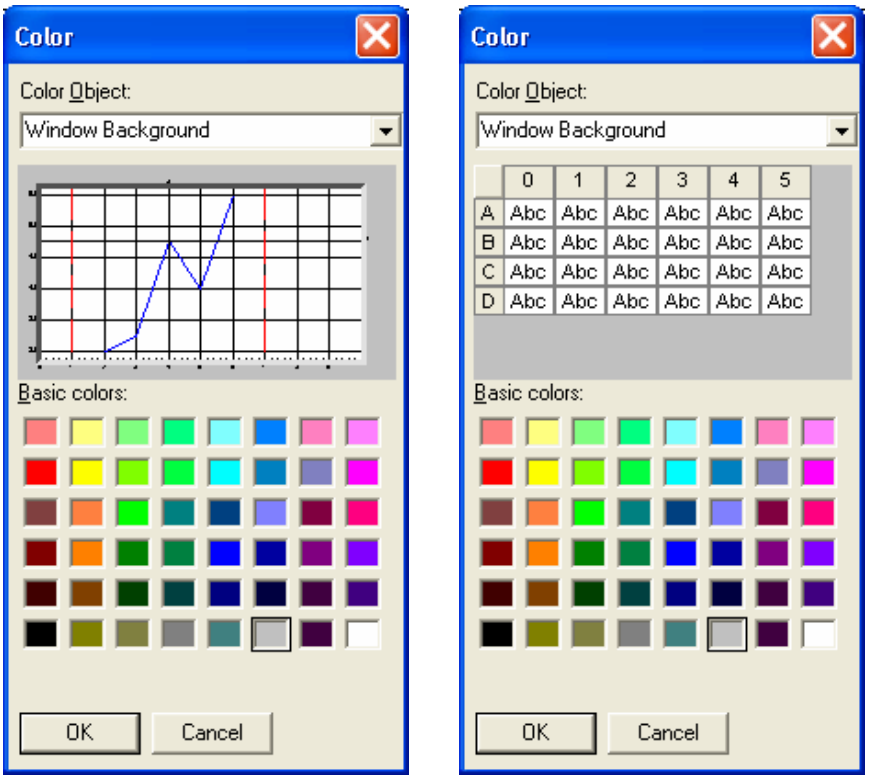
Display graphs with a vertical grid.

Display graphs with both horizontal and vertical grids.

Color

Select **Format | Color** to change the colors used to display items in the active window.

When you select **Format | Color**, the Graph Color or Table Color window opens depending on the active window on the desktop (Figure 4-16 shows both). These windows include a preview screen, a drop down list and a color palette. From the drop down list, select the name of the item you want to modify. The current color for that item is indicated in the color palette. Use the mouse to point to the new color for that item and click the left mouse button to select it. The preview screen then displays the item in the new color.



(A) **(B)**

Figure 4-16
(A) The Graph Color Dialog Box, (B) The Table Color Dialog Box

Select items from the drop down list and colors as desired. When finished, press **OK**; the colors you selected will be used from that point on in all graphs and/or tables.

The items you can select for windows containing graphs are:

- Window Background
- Plot Area Background
- Labels
- Axis
- Data
- Channel View Boundaries
- Data Hotspot Lines

The items you can select for windows containing tables are:

- Window Background
- Cell Text
- Grid Color
- Cell Background
- Fixed Area Text

Font

Select the **Format | Font** menu to change the style and size of the text in all graphs or tables.

Select **Format | Font | Style...** to select a new font or change the font style, see Figure 4-17. You can select any font and font style available on your computer. The preview box lets you see what the text will look like before you implement it by selecting **OK**.

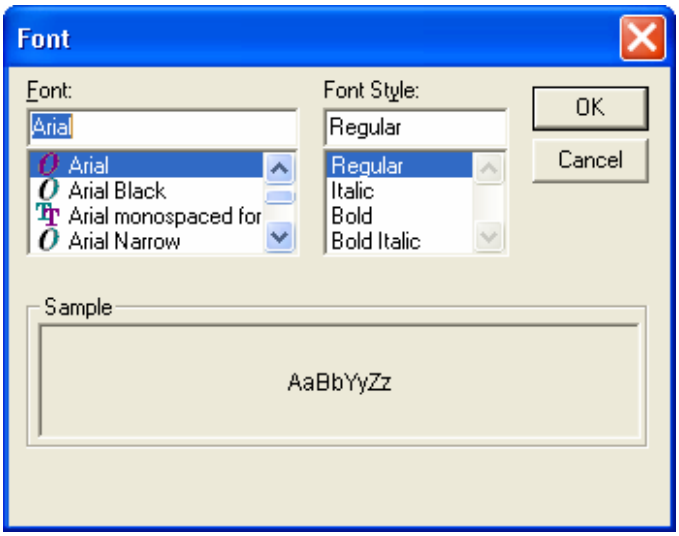


Figure 4-17
The Font Dialog Box

To change the font size, select **Format | Font | Small**, **Medium**, or **Large** (the default is Medium). To change the text size without using the menus, select the icon from the toolbar. Each time you select the icon the text size changes to the next text size. (Rotation is from small to medium to large.)

Rotation (APS 3320, APS 3321 and UV-APS only)

When a 3D graph is active, select **Format | Rotation** to bring up a dialog box that allows you to enter the x, y, and z rotation of the 3D

graph. See “How To Rotate a 3D Graph” earlier in this chapter for a figure and description of the dialog box.

Graph Type (3D for APS 3320, APS 3321 and UV-APS only)

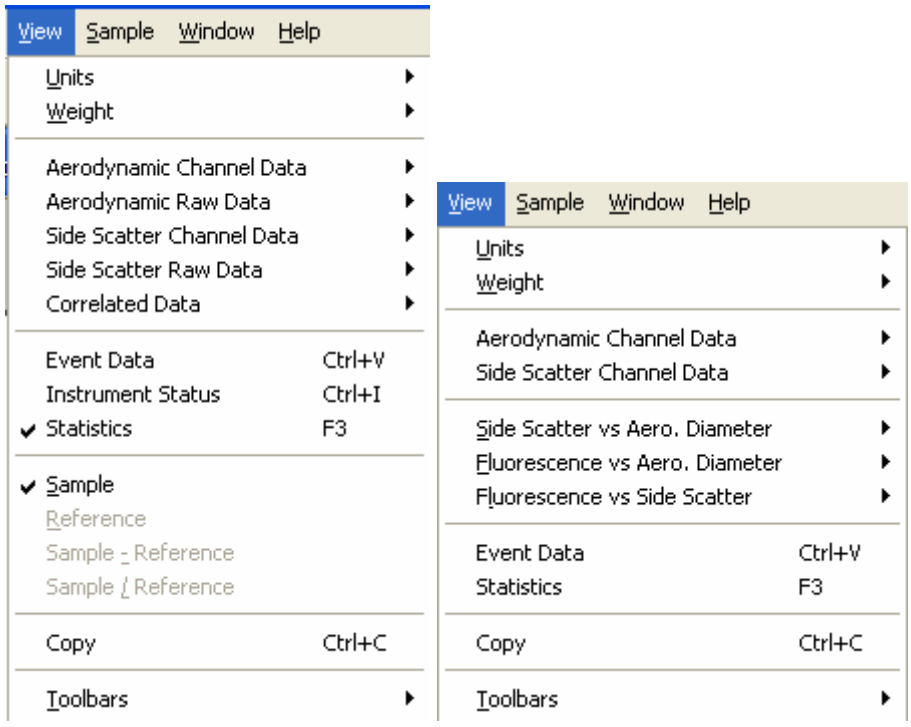
Select **Format | Graph Type** to bring up a dialog box that allows you to choose the graph type that best represents your data. See “How To Change the 3D Graph Type” earlier in this chapter for a figure and description of the dialog box.

Undo Zoom

Select **Format | Undo Zoom** to return a graph to its “normal” viewing size after you have zoomed in on a portion of the graph. See “Zoom In and Out on Data in a Graph” in Chapter 3.

View Menu

The list of items in the View menu depends on which windows are open on the desktop and which one is active. The View menu lets you select the sample windows to open on the desktop and select parameters to view in those windows. A checkmark next to an item indicates the item has already been selected. Look under the Windows menu to find the item and make it the active window.



(A) **(B)**

Figure 4-18
View Menu for (A) an APS Spectrometer, (B) a UV-APS Spectrometer

Units

The Units menu item appears when a graph or data table window is active on the desktop (except a raw data or event data window). This menu item works in conjunction with the Weight menu item, and lets you choose the units in which data will be displayed.

Unit selections include:

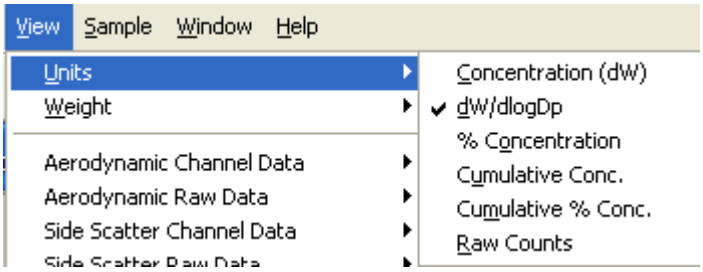


Figure 4-19
Units Selection Menu

The currently selected unit is marked with a check mark. This was set by selecting **View | Units | dW/dlogDp**.

Table 4-7 gives an explanation of each unit.

Table 4-7
Display Options for Units

View Units	Description
dW/dlogDp	This option displays differential or normalized particle size distribution, normalized to one decade of particle size. This normalized concentration format allows particle size distributions to be compared regardless of the channel resolution. dW/dlogDp = dW × resolution in channels/decade. W represents the weighting of the distribution, which can be N (number), S (surface area), V (volume), or M (mass).
Concentration (dW)	This option displays interval particle size distributions. The concentration in any channel represents the concentration within the particle size boundaries for that channel. W represents the weighting of the distribution, which can be N (number), S (surface area), V (volume), or M (mass).
% Concentration	This option displays each particle size channel as a percentage of the total particle concentration.
Cumulative Conc.	This option displays the particle concentration in a cumulative or summed format. Each particle size channel represents the total concentration of particles measured below its upper size boundary.
Cumulative % Conc.	This option is the same as Cumulative Conc., but displayed as a percentage of the total concentration.

View Units	Description
Counts/Raw Counts	Counts/Raw Counts are the lowest level of data representation, raw detected particle counts put into channels by size, but without any corrections. Mapping of particle size within the program can cause single counts to be split across two channels.

Figure 4-20 shows an aerodynamic diameter graph displayed in number % concentration using data from a 3321 APS spectrometer.

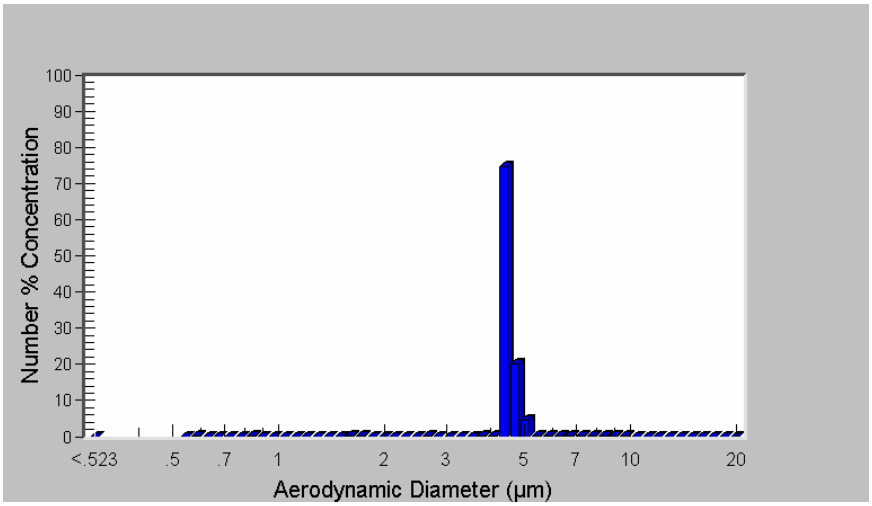


Figure 4-20
Aerodynamic Diameter Data Displayed in Number % Concentration

Weight

The Weight menu item appears only when an Aerodynamic Diameter Graph window is active on the desktop. This menu item works in conjunction with the Units menu item and lets you choose how to “weight” the units that are displayed.

You can select:

- Number
- Surface
- Mass

The currently selected weight is marked with a check mark. Table 4-8 gives an explanation of each unit.

Table 4-8
Weight Options

View Units	Description
Number	Number represents the total number of particles per unit volume of air sampled (i.e., number concentration expressed as #/cm^3). Number concentration is the primary measurement of the APS system. The spectrometer is sensitive to the number of particles in the aerosol sample as opposed to the particle mass, color, shape, composition or other characteristic. The distributions of surface area or mass concentrations of the particles are calculated based on the particle number distribution. The number concentration, dN, measured by the APS is the concentration of particles in a given channel. The normalized number concentration, dN/dlogDp, is calculated by dividing dN by the geometric width of the size channel.
Surface	Surface represents the total surface area of the particles per unit volume of air sampled (i.e., surface area concentration expressed as nm^2/cm^3). The surface area concentration calculation assumes that all the particles are perfect spheres. Surface area concentration is calculated by: $dS=dN \cdot \pi D_p^2$, where D_p is the geometric midpoint of the particle size channel. Note that the APS measures the aerodynamic diameter of particles. The relationship between the geometric diameter (D_p) and aerodynamic diameter (D_a) is given in Appendix C. The normalized surface concentration based on geometric diameter is: $dS/d\log D_p=dN/d\log D_p \cdot \pi D_p^2$.
Mass	Mass represents the total mass of the particles per unit volume of air sampled (i.e., mass concentration expressed as µg/cm^3). The mass concentration calculation assumes that all the particles are perfect spheres with the density defined in the Run|Properties dialog for the instrument. Mass concentration is calculated by: $dM=dN \cdot (\pi/6)D_p^3\rho$, where D_p is the geometric midpoint of the particle size channel and ρ is the density. Note that the APS measures the aerodynamic diameter of particles. The relationship between the geometric diameter (D_p) and aerodynamic diameter (D_a) is given in Appendix C. The normalized mass concentration based on geometric diameter is: $dM/d\log Dp=dN/d\log Dp \cdot (\pi/6)D_p^3\rho$.

In many of the tables, the values for all three weightings are supplied in tabular format.

Note: *Surface and Mass weighting calculations assume that all the particles are spherical. Mass calculations also assume that all particles have the density defined in the properties dialog for the instrument. However, comparisons to methods that measure particle surface or mass directly may give results different from those calculated by the software.*

Figure 4-21 shows sample aerodynamic diameter data in units of cumulative concentration weighted by mass.

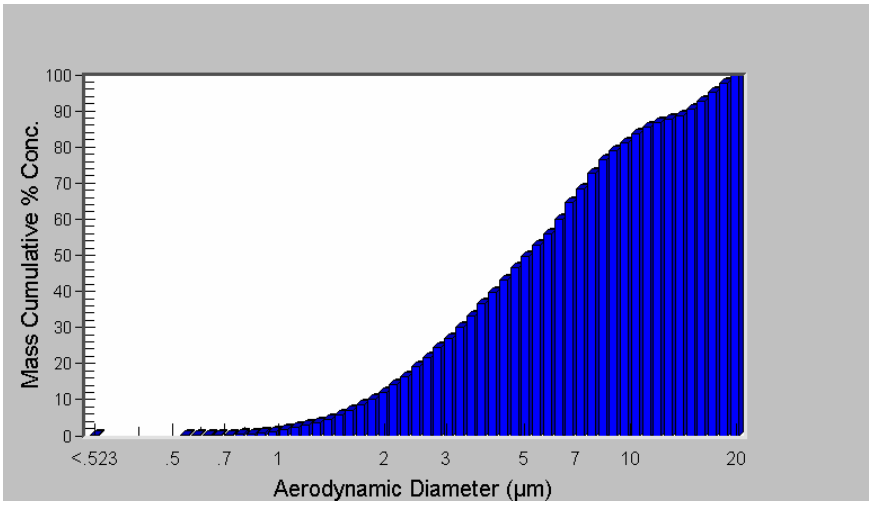


Figure 4-21
Aerodynamic Diameter Data Weighted by Mass

Aerodynamic Channel Data

Select **View | Aerodynamic Channel Data | Graph** or **View | Aerodynamic Channel Data | Table** to open a window displaying the aerodynamic diameter data of the active sample. (By default, the active sample is the first sample in the file.)

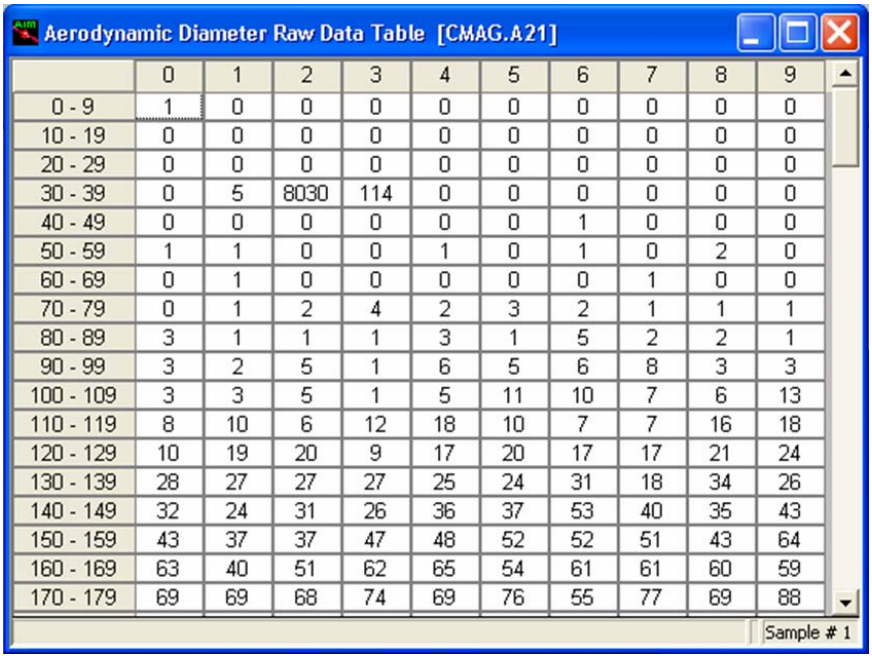
Aerodynamic Raw Data (APS 3310, APS 3320 and APS 3321 only)

Select **View | Aerodynamic Raw Data | Graph** or **View | Aerodynamic Raw Data | Table** to open a window displaying the aerodynamic raw data of the active sample. (By default, the active sample is the first sample in the file.)

The raw data, which is available only for the APS 3310, APS 3320 and APS 3321, consists of 1024 channels of aerodynamic diameter data that the APS collected. This data is converted, using a calibration curve, into equally sized and spaced bins over the measurement range of the spectrometer to give channel data.

Note: *If you did not collect this raw data initially, as specified in the Properties window, then no data can be displayed.*

Figure 4-22 illustrates an aerodynamic diameter raw data table.



	0	1	2	3	4	5	6	7	8	9
0 - 9	1	0	0	0	0	0	0	0	0	0
10 - 19	0	0	0	0	0	0	0	0	0	0
20 - 29	0	0	0	0	0	0	0	0	0	0
30 - 39	0	5	8030	114	0	0	0	0	0	0
40 - 49	0	0	0	0	0	0	1	0	0	0
50 - 59	1	1	0	0	1	0	1	0	2	0
60 - 69	0	1	0	0	0	0	0	1	0	0
70 - 79	0	1	2	4	2	3	2	1	1	1
80 - 89	3	1	1	1	3	1	5	2	2	1
90 - 99	3	2	5	1	6	5	6	8	3	3
100 - 109	3	3	5	1	5	11	10	7	6	13
110 - 119	8	10	6	12	18	10	7	7	16	18
120 - 129	10	19	20	9	17	20	17	17	21	24
130 - 139	28	27	27	27	25	24	31	18	34	26
140 - 149	32	24	31	26	36	37	53	40	35	43
150 - 159	43	37	37	47	48	52	52	51	43	64
160 - 169	63	40	51	62	65	54	61	61	60	59
170 - 179	69	69	68	74	69	76	55	77	69	88

Figure 4-22
Example of Table of Raw Data for Aerodynamic Diameter

Side Scatter Channel Data (APS 3320, APS 3321 and UV-APS)

Select **View | Side Scatter Channel Data | Graph** or **View | Side Scatter Channel Data | Table** to open a window displaying the side scatter data of the active sample. (By default, the active sample is the first sample in the file.)

Side Scatter Raw Data (APS 3320 and APS 3321 only)

Select **View | Side Scatter Raw Data | Graph** or **View | Side Scatter Raw Data | Table** to open a window displaying the side scatter raw data of the active sample. (By default, the active sample is the first sample in the file.)

The raw data for the APS 3320 consists of 256 channels of side scatter data; the raw data for the APS 3321 consists of 64 channels. This data is converted, using a calibration curve, into equally sized and spaced bins over the measurement range of the spectrometer to give channel data.

Note: *If you did not collect this raw data initially, as specified in the Properties window, then no data can be displayed.*

Correlated Data (APS 3320 and APS 3321 only)

Select **View | Correlated Data | Graph** to open a window that displays the correlated data of the active sample. (By default, the active sample is the first sample in the file.)

You can view correlated data (**View | Correlated Data**) as a graph or a table.

Note: *If you did not collect correlated data, as specified in the Properties window, then no data can be displayed.*

Side Scatter vs Aero. Diameter (UV-APS only)

Select **View | Side Scatter vs Aero. Diameter | Graph** to open a window that displays a three-dimensional graph of the Side Scatter vs. Aerodynamic Diameter data of the active sample. (By default, the active sample is the first sample in the file.)

You can view Side Scatter vs. Aerodynamic Diameter data (**View | Side Scatter vs Aero. Diameter**) as a three-dimensional graph or a table.

Note: *If you did not collect Side Scatter vs. Aerodynamic Diameter data, as specified in the Properties window, then no data can be displayed.*

Fluorescence vs Aero. Diameter (UV-APS only)

Select **View | Fluorescence vs Aero. Diameter | Graph** to open a window that displays a three-dimensional graph of the Fluorescence vs. Aerodynamic Diameter data of the active sample. (By default, the active sample is the first sample in the file.)

You can view Fluorescence vs. Aerodynamic Diameter data (**View | Fluorescence vs Aero. Diameter**) as a three-dimensional graph or a table.

Note: *If you did not collect Fluorescence vs. Aerodynamic Diameter data, as specified in the Properties window, no data can be displayed.*

Fluorescence vs Side Scatter (UV-APS only)

Select **View | Fluorescence vs Side Scatter | Graph** to open a window that displays a three-dimensional graph of the Side Scatter vs. Aerodynamic Diameter data of the active sample. (By default, the active sample is the first sample in the file.)

You can view Side Scatter vs. Aerodynamic Diameter data (**View | Fluorescence vs Side Scatter**) as a three-dimensional graph or a table.

***Note**: If you did not collect Fluorescence vs. Side Scatter data, as specified in the Properties window, no data can be displayed.*

Event Data (APS 3320, APS 3321 and UV-APS)

Select **View | Event Data** to open a window displaying the percentage of event 1, 2, 3 and 4's. You can view the actual number of particles of an event type by positioning your mouse on that bar and clicking the left mouse button (See "Select a Data Hot Spot" in Chapter 3 for more information on data annotation). Click on the bar again to remove the annotation.

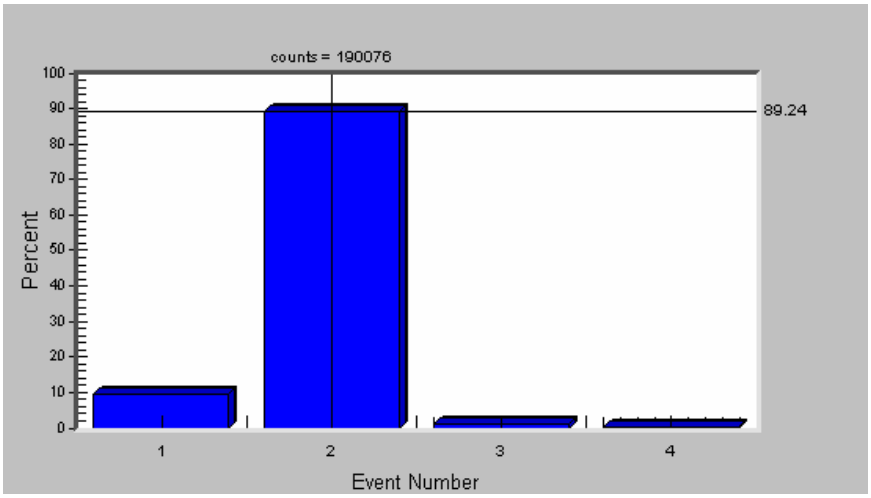


Figure 4-23
Event Data

Instrument Status (APS 3320 and APS 3321 only)

Select **View | Instrument Status** to open a window that displays the status of the instrument. The instrument status is only available when you have a corresponding data sample.

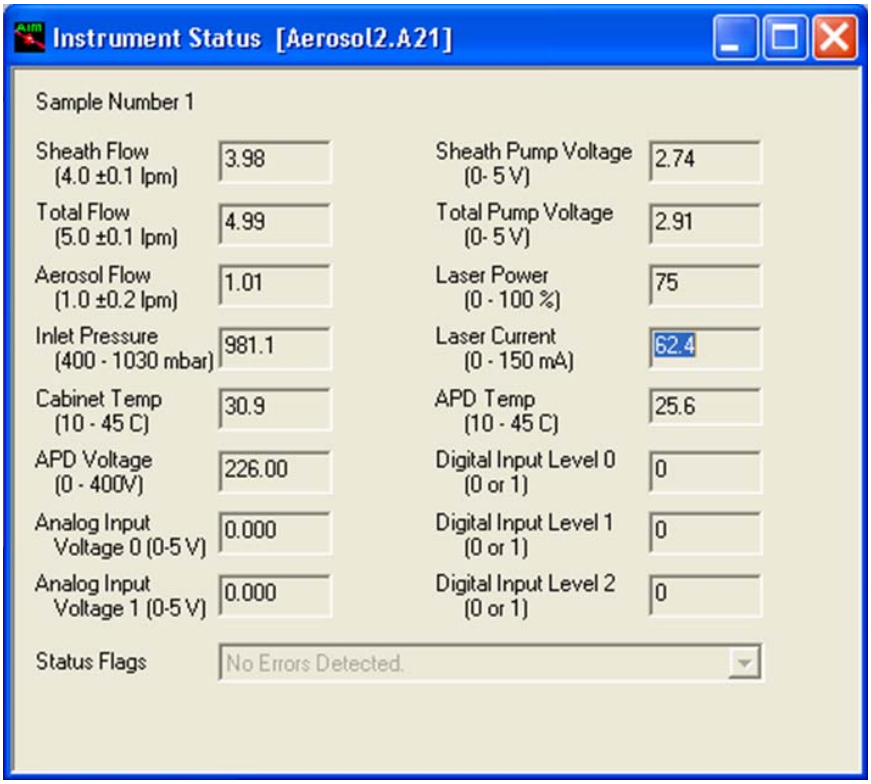


Figure 4-24
Instrument Status

Table 4-9 gives an explanation of each field.

Table 4-9
Instrument Status Fields

Status Field	Description
Sample Number	Sample number of the current data sample.
Sheath Flow	Displays the flow rate of the outer nozzle (sheath) flow. This reading will approximate 4.0 (±0.1) liter per minute.
Total Flow	Displays the total flow rate of the sample aerosol. This reading will approximate 5.0 (±0.1) liter per minute.
Aerosol Flow	Total flow – Sheath flow. Displays the flow rate of the inner nozzle (sample) aerosol. This reading will approximate 1.0 (±0.1) liter per minute.
Inlet Pressure	Displays the inlet pressure of the sample. This value should correspond to your atmospheric pressure. The range is 400–1030 mbar.

Status Field	Description
Cabinet Temperature	Displays the temperature inside the APS. The range is 10–45°C.
APD Voltage	Displays the voltage of the Avalanche Photodetector (APD). The range is 0–400 volts.
Analog Input Voltage 0	Allows the user to log external analog data (i.e., temperature or flow data) that is relative to the sample. The range is 0–5 volts.
Analog Input Voltage 1	Allows the user to log external analog data (i.e., temperature or flow data) that is relative to the sample. The range is 0–5 volts.
Status Flags	Displays the instrument status flags that are set. If no flags are set, the message “No Errors Detected” is displayed. If only one of the flags is set, its error message is displayed. If more than one flag is set, the message “Errors Detected.” is displayed. If you are not collecting data, you can drop the combo box to view all of the flags that are set.
Sheath Pump Voltage	Displays the voltage of the sheath flow pump. The range is 0–5 volts.
Total Pump Voltage	Displays the voltage of the total flow pump. The range is 0–5 volts.
Laser Power	Displays the percent of laser power used from 0–100%. Default is 75%.
Laser Current	Displays the laser current in milliamps. The range should be between 0 and 100 mA. This value rises as the laser ages.
APD Temperature	Displays the temperature of the Avalanche Photodetector (APD). The range is 10–45°C.
Digital Input Level 0	Allows the user to log external digital data (i.e., valve position) that is relative to the sample. The range is 0 or 1 volt.
Digital Input Level 1	Allows the user to log external digital data (i.e., valve position) that is relative to the sample. The range is 0 or 1 volt.
Digital Input Level 2	Allows the user to log external digital data (i.e., valve position) that is relative to the sample. The range is 0 or 1 volt.

Statistics

Select **View | Statistics** to open a window of statistical information for the active sample, see Figure 4-25. The equations used for calculating the values are described in Appendix C.

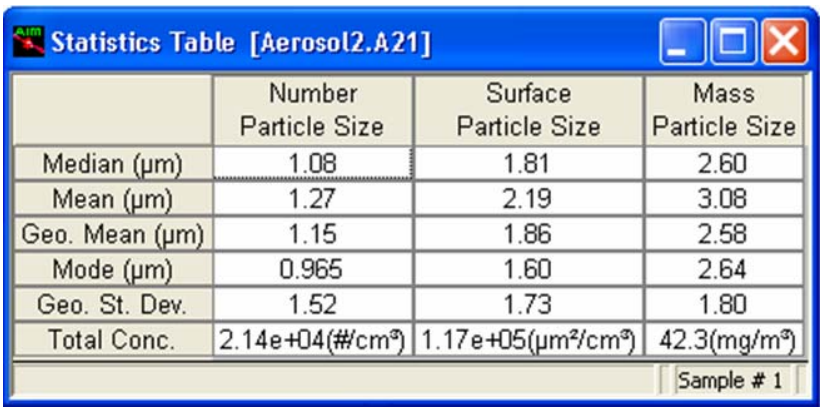

Statistics Table [Aerosol2.A21]
Number Particle Size
Surface Particle Size
Mass Particle Size
Median (µm) 1.08 1.81 2.60
Mean (µm) 1.27 2.19 3.08
Geo. Mean (µm) 1.15 1.86 2.58
Mode (µm) 0.965 1.60 2.64
Geo. St. Dev. 1.52 1.73 1.80
Total Conc. 2.14e+04(#/cm³) 1.17e+05(µm²/cm³) 42.3(mg/m³)
Sample # 1

Figure 4-25
Statistics Table

Sample

Select **View | Sample** to view the current sample selected in the Samples List window.

Reference

Select **View | Reference** to view the reference buffer selected with **Sample | Select as Reference**.

Note: *Only the Time of Flight channel data can be selected as a reference sample. Reference buffer operations do not apply to other data types.*

Sample–Reference

Select **View | Sample-Reference** to view the current sample minus (–) the reference sample. This menu item is not available if no sample has been selected as a reference using **Sample | Select as Reference**.

Sample-Reference is only allowed for the following units: Concentration (dW), dW/dlogDp, and Cumulative Conc.

Sample/Reference

Select **View | Sample/Reference** to view the current sample divided by (/) the reference sample. This menu item is not available if no sample has been selected as a reference using **Sample | Select as Reference**.

Sample/Reference is only allowed for the following units: Concentration (dW), dW/dlogDp, and Cumulative Conc.

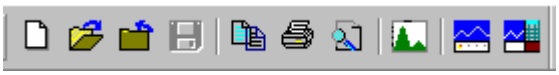
Note: *Statistics are not calculated for this option. All fields in the table will be blank.*

Copy

Select **View | Copy** or from the toolbar to copy the active window to the clipboard so that you can "paste" it in other applications, for example a word processing program.

Toolbars

Select **View | Toolbars** to display or hide the toolbars that appear on the desktop. Each toolbar is illustrated below:

 Main Toolbar

Color and Font Toolbar

Graph Toolbar

Navigation Toolbar

The Merge icon appears on the main toolbar if the appropriate software (Data Merge Software) has been installed. See Chapter 2, "Installing the Software" for more information.

By default, only the Main and Navigation toolbars are displayed.

To view what each icon (tool) does, position the cursor on the icon. A balloon will appear to describe the function of the icon.

Toolbars can be moved and resized if desired. To move a toolbar, position the cursor on a gap between two tools and press and hold the left mouse button. As you move the mouse, the toolbar moves with it. To resize a toolbar, position the cursor at an edge or corner of the toolbar window that you have moved and resize it as desired. You can hide a toolbar by selecting the "x" in the upper right corner.

Sample Menu

The Sample menu lets you navigate through files with multiple samples.

Note: *You can also navigate through files with multiple samples using the Navigation toolbar.*

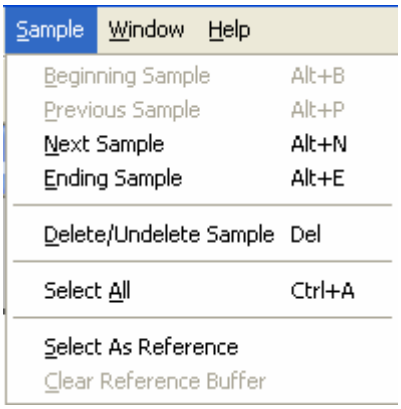


Figure 4-26
Sample Menu

Beginning Sample

Select **Sample | Beginning Sample** or from the toolbar to display the data for the first sample of the file in the active window.

Previous Sample

Select **Sample | Previous Sample** or from the toolbar to display the data for the previous sample of the file in the active window.

Next Sample

Select **Sample | Next Sample** or from the toolbar to display the data for the next sample of the file in the active window.

Ending Sample

Select **Sample | Ending Sample** or from the toolbar to display the data for the last sample of the file in the active window.

Delete/Undelete Sample

Select **Sample | Delete/Undelete Sample** to select (highlight) a sample in the Samples List window for deletion (or to unselect a sample marked for deletion). Samples marked for deletion are not actually deleted from file until you perform a **File | Save** or **File | Close**.

Select As Reference

Select **Sample | Select As Reference** to select the current sample as a reference sample. This sample can then be subtracted from the current sample or you can divide the current sample by the reference sample. Refer to the View menu items above.

Note: *Only the Time of Flight channel data can be selected as a reference sample. Reference buffer operations do not apply to other data types.*

Clear Reference Buffer

Select **Sample | Clear Reference Buffer** to clear the reference buffer.

Select All

Select **Sample | Select All** to select (highlight) all samples in the Samples List window for playback or exporting. This item is only available when the Samples List window is the active window.

Window Menu

The Window menu items let you open, close and arrange the windows on your desktop. Refer to your Windows documentation for an example of what each command does.

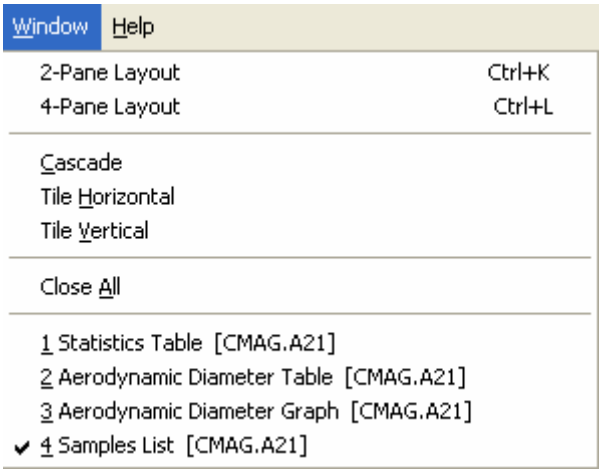


Figure 4-27
Window Menu

All windows on the desktop, whether active or inactive, are listed after the Close All command; the active window is shown with a check mark. To make a different window active and bring it to the front, select it with the mouse.

Help Menu

The Help menu provides access to information about the program.

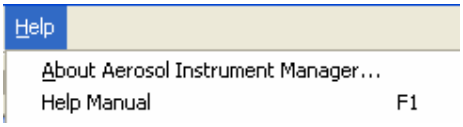


Figure 4-28
Help Menu

About Aerosol Instrument Manager

Select **About Aerosol Instrument Manager** to see the copyright statement for the program and view the version number of the software.

Help Manual

Select **Help | Help Manual** to see the manual of the Aerosol Instrument Manager software for APS.

APPENDIX A

Data Files, Project Files, and Stored Parameters

The Aerosol Instrument Manager® Software stores data in two types of files: data files and project files. This appendix describes those files and the parameters stored in them. In addition, it also describes the parameters stored in the aim.ini file.

Data Files and Project Files

The Aerosol Instrument Manager Software uses two types of files:

- Data files
- Project files

Data files contain sample data. They have a filename extension to indicate the type of spectrometer from which data was collected, such as .a21 for an APS 3321. Other information stored in data files includes:

Information stored for the whole file:

Density
Sample time
Efficiency filename
Time file started

Information stored for each APS 3312, APS 3320 and APS 3321 sample:
Status flags
Inlet pressure
Total flow rate
Sheath flow rate
Analog input voltage 0
Analog input voltage 1
Digital input level 0
Digital input level 1
Digital input level 2
Laser power

Laser current
Sheath pump voltage
Total pump voltage
Inlet temperature
Box temperature
APD temperature
APD voltage

Project files are created by the program when you open a data file and work with it. They have an extension to indicate the type of spectrometer that they are the project files for (for example, .p21 for an APS 3321). Project files keep track of "cosmetic" attributes like which windows are open on the desktop when you close the file and how that information is displayed.

If you transfer data files to someone, you do not need to transfer the project files unless you want to. If you delete a project file, a new project file is created when you reopen the data file.

Project File Parameters

The following parameters are saved for each window (i.e., the Units for the Aerodynamic Diameter table will be stored for the Aerodynamic Diameter table only, the Units for the graph are stored only for the graph):

- The graph type (bar, line, or area)
- The grid type (none, vertical, horizontal or both vertical and horizontal)
- Y axis scale parameters
- Units and weights selected
- List type, for the Samples List window
- Position and size of the window

The following parameters apply to the entire file (not to each individual window):

- Stokes correction
- Phantom counts (APS 3310 only)
- View range
- Playback delay time
- Current sample index (the sample number of the sample you were viewing when you exited the program)
- Reference sample.

Saved Parameters

The following parameters are stored for the Aerosol Instrument Manager application and are applied to all documents:

- Font and color for tables.
- Font and color for graphs.
- Aerosol Instrument Manager window size and position.

The following parameters are stored for the same instrument type:

- Window positions the last time a file was closed.
- Parameters from each different instrument Properties dialog box.

APPENDIX B

Accelerator Keys

Accelerator keys are those keys and key combinations that allow you to perform operations using only your keyboard (no mouse required).

These are the accelerator keys that can be used with an APS™ spectrometer.

Key(s)	Action for APS
F1	Help
F3	View statistics
F4	View sample list
F5	View Aerodynamic data graph
Shift F5	View Aerodynamic data table
F6	View Aerodynamic raw graph
Shift F6	View Aerodynamic raw table
F7	View side scatter graph
Shift F7	View side scatter table
F8	View side scatter raw graph
Shift F8	View side scatter raw table
F9	View correlated graph
Shift F9	View correlated table
F10	Record sample
Shift F10	Finish recording current sample
Alt B	Go to first sample “Begin”
Ctrl A	Select all samples
Ctrl C	Copy current view to clipboard
Alt E	Go to last sample “End”
Ctrl I	Instrument Status
Ctrl K	2-Pane Window Layout
Ctrl L	4-Pane Window Layout
Alt N	Next sample
Ctrl N	New document
Ctrl O	Open a document
Alt P	Previous sample
Ctrl P	Print current view
Ctrl R	View Sample Properties
Ctrl S	Save

Key(s)	Action for APS
Ctrl V	View Event Data
Z	Undo Zoom

APPENDIX C

Calculations Used for APS Spectrometers

This appendix gives an explanation of the statistics calculations used by the Aerosol Instrument Manager® Software. The statistics are calculated for the interval defined by the upper and lower bounds selected from the graphs, which are not necessarily the entire size range of the instruments. Please note that surface area, volume, and mass calculations in the table are based on geometric diameter of particles (D_p) while the APS measures the aerodynamic diameter of particles (D_a). The relationship between the two types of diameters is given later in this appendix.

Statistic/Weight	Number	Surface Area	Volume	Mass
Concentration	$n = \frac{c}{tQ}\frac{\phi}{\eta}$	$s = \pi D_p^2 n$	$v = \frac{\pi D_p^3 n}{6}$	$m = \rho v$
Total Concentration	$N = \sum_l^u n$	$S = \sum_l^u s$	$V = \sum_l^u v$	$M = \sum_l^u m$
Mode	$D_p(n_{\max})$	$D_p(s_{\max})$	$D_p(v_{\max})$	$D_p(m_{\max})$
Median ($\tilde{x}$)	$D_p(N/2)$	$D_p(S/2)$	$D_p(V/2)$	$D_p(M/2)$
Mean ($\bar{x}$)	$\frac{\sum_l^u nD_p}{N}$	$\frac{\sum_l^u sD_p}{S}$	$\frac{\sum_l^u vD_p}{V}$	$\frac{\sum_l^u mD_p}{M}$
Geometric Mean ($\bar{x}_g$)	$\exp\left[\frac{\sum_l^u n \ln D_p}{N}\right]$		substitute s, v, m and S, V, M in place of n and N for other weightings	
Geometric Standard Deviation (σ_g)	$\exp\left[\frac{\sum_l^u n\left[\ln D_p - \ln \bar{x}_g\right]^2}{N}\right]^{1/2}$		substitute s, v, m and S, V, M in place of n and N for other weightings	

The symbols used in the formulas are defined as:

c = particle counts per channel
n = number weighted concentration per channel
s = surface area weighted concentration per channel
v = volume weighted concentration per channel
m = mass weighted concentration per channel
η = sample efficiency factor per channel
ϕ = sample dilution factor
D_a = aerodynamic particle diameter
D_p = geometric particle diameter (channel midpoint)

C = total particle counts
N = total number concentration
S = total surface area concentration
V = total volume concentration
M = total mass concentration

Q = sample flowrate
t = sample time
ρ = particle density
ln = natural log
exp = base of natural log (e)
l = lower channel boundary
u = upper channel boundary

The relationship between the aerodynamic particle diameter (D_a) measured by the APS and the geometric particle diameter (D_p) is

$$D_p = D_a \sqrt{\frac{\rho_0}{\rho}}$$

where ρ_0 is the unit density (1 g/cm^3).

According to this relationship, for a fixed aerodynamic size distribution measured by the APS, the total mass m decreases to $m / \sqrt{N}$ when particle density ρ increases to $N \bullet \rho$.

For example, there are two spherical particles (No. 1 and No. 2) with an identical aerodynamic diameter D_a. Particle No. 1 has a density of ρ_1 and a geometric diameter of D_{p1} and particle No. 2 has a density of ρ_2 and a geometric diameter of D_{p2}. The density of particle No. 1 is N times of the density of particle No. 2 ($\rho_1 = N \bullet \rho_2$). The mass of particle No. 1 is thus $1 / \sqrt{N}$ times of the mass of particle No. 2 as shown in the following calculations.

$$D_{p1} = D_a\sqrt{\frac{\rho_0}{\rho_1}} = D_a\sqrt{\frac{\rho_0}{N\rho_2}} = \frac{1}{\sqrt{N}}\left(D_a\sqrt{\frac{\rho_0}{\rho_2}}\right) = \frac{1}{\sqrt{N}}D_{p2}$$

$$m_1 = \frac{\pi}{6}\rho_1 {D_{p1}}^3 = \frac{\pi}{6}(N\rho_2)\left(\frac{1}{\sqrt{N}}D_{p2}\right)^3 = N\left(\frac{1}{\sqrt{N}}\right)^3 \cdot \left(\frac{\pi}{6}\rho_2 {D_{p2}}^3\right) = \frac{1}{\sqrt{N}}m_2$$

APPENDIX D

Stokes Correction for APS Spectrometers

This appendix gives an explanation of the Stokes Correction algorithm used by the Aerosol Instrument Manager® Software to improve the particle sizing accuracy of each of the APS instruments. Stokes correction should be turned on while sampling particles with density below 0.9 g/cm^3 or above 1.1 g/cm^3. If you are sampling particles inside this range or if you are primarily interested in particles below 1 µm, Stokes correction should be turned off.

The APS spectrometers are calibrated at the factory using Polystyrene Latex (PSL) spheres of density close to 1.05 g/cm^3. In addition, the APS does not measure the aerodynamic size of particles in still air (the classical definition of aerodynamic size) but in a flow velocity of approximately 150 m/s. This means that the particle Reynolds numbers are outside the Stokes regime (R > 0.5). This is fine if the particles measured by the APS are close to unit density. However, for particle densities other than unity, the particles will be incorrectly sized smaller for densities below unity and sized larger for densities above unity. The magnitude of this difference increases for larger particle sizes. For example, a particle of density 0.8 g/cm^3 can be underestimated by as much as 5% and a particle of density 2 g/cm^3 can be overestimated by as much as 10%.

If the density of the particles is known, the non-Stokes error can be corrected using equations (8), (9), and (10) from the paper by Hwa-Chi Wang and Walter John (1987), "Particle Density Correction for The Aerodynamic Particle Sizer," *Aerosol Science and Technology* **6**(2):191-198.

$D_{a2} = D_{a1}\left[\frac{6 + R_2^{2/3}}{6 + R_1^{2/3}}\right]^{1/2}$	D_{a2} = corrected aerodynamic diameter [µm] D_{a1} = uncorrected aerodynamic diameter [µm] R_1 = see below R_2 = see below

$R_1 = \frac{\rho_a (U - \overline{V}) D_1}{\mu \sqrt{\rho_1}}$	ρ_a = air density [g/cm^3] (air @ 20C = 1.205E-3 g/cm^3) μ = air viscosity [dyne•s/cm^2] (air @ 20C = 1.81E-4 dyne•s/cm^2) ρ_1 = calibration particle density [g/cm^3] (PSL = 1.05 g/cm^3) U = air velocity [cm/s] (typically 15000 cm/s) V = average particle velocity [cm/s] (depends on particle size)
$R_2 = \frac{\rho_a (U - \overline{V}) D_2}{\mu \sqrt{\rho_2}}$	ρ_2 = actual particle density [g/cm^3] (supplied by user)

Note that the equation for R_2 also contains the corrected aerodynamic diameter, D_2. This means that the equation must be solved iteratively with $D_2 = D_1$ as the initial value. Usually five iterations are sufficient to get less than 0.1% error. The iteration is performed for each particle size in the range of the APS based on the average of the size channel and the next channel. The value for U is calculated based on $U = L/T$ where L is the distance between the laser beams and T is the transit time between the beams based on the first raw data channel. L is assumed to be 120 µm for the APS 3310 and 100 µm for the APS 3312, APS 3320 and APS 3321.

Note also that the equations use the simplifying assumption of a Cunningham slip correction factor of unity for particles greater than 1 µm. This assumption can introduce errors for particle sizes below 1 µm.

APPENDIX E

Sequence Files

The files for sample sessions that run past midnight (or run for more than 24 hours) are handled differently than those that start and stop on the same date. (Midnight occurs on your system according to the setting of your computer's system clock.)

For these sample sessions, a **sequence of files** is created, with each file in the sequence given a unique filename extension identifying its proper order.

Normally, only a single file is created for any sample session and it has a filename extension of the form .a21. For example, Atomosphere.a21, which would identify the file as an APS file.

If the sample session period runs past midnight, a file is created for each date (day). The samples collected before midnight (including the sample that is running at midnight) are collected in a file with the normal extension, i.e., .a21

Samples that are collected after midnight are saved in a file with an extension of the form ".1.a21" . (Using the same example as above, the next filename would be "Atmosphere.1.a21.")

For a very long sample session, a file is created each time the sample session runs past midnight and is indicated by adding a new number to the file extension. Using the previous example, the file following "Atmosphere.1.a21" is "Atmosphere.2.a21" and the next file would be "Atmosphere.3.a21" and so on.

These files contain information to link them when opened and the files can be recalled as if they were a single file. The files may also be selected and opened as individual files.

When you save the samples collected during a sample session that runs past midnight, you provide a filename just as you would for any sample session. You do *not* provide any extensions. The software automatically adds a file extension.

Opening a File That is Part of a Sequence

If you select **File | Open** and the file is part of a sequence of files (i.e., the sample session ran over midnight), the following dialog box appears:

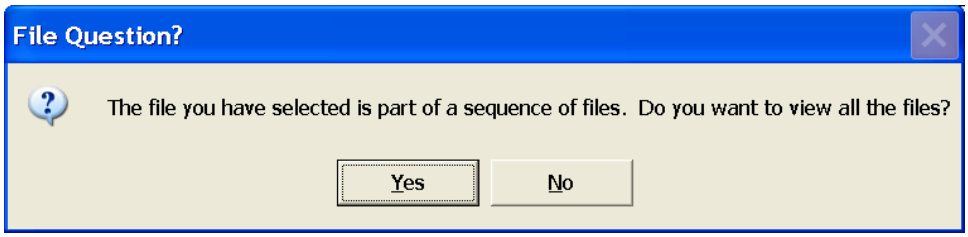


Figure E-1
File Question? Dialog Box

You have the option of opening all the files or only a single one.

If you select **No**, only the file you have selected will open and only the samples in that file will be available to you.

If you select **Yes**, all files in the sequence will open and the samples from the entire session are available as if you had opened a single file.

Note: *If you select **View | Samples List | Details**, you can see the pathname for each sample.*

When you open a sequence of files, the software looks for the first file of that sequence (i.e., the one with the .s80 extension and opens all files in sequence beginning with that file). If a sequence file is unavailable (for example, it has been deleted, moved or corrupted), the software opens the files until it comes to the missing file. For example, if you try to open a sequence of files that contains seven files and the fourth file is missing, only the first three files can be opened. Files five, six, and seven are "orphaned." These remaining files (5, 6, and 7) can only be opened individually, not as a sequence.

APPENDIX F

Error Messages

This appendix lists the messages you may encounter when using the software and suggests the action you should take.

Table F-1
Error Messages for APS

Error Message	Description
<file> already exists. Do you want to replace it?	The file you selected for File	New is an existing data file. If you would like to overwrite the file, select **Yes**. Otherwise, select **No** and enter a different file name in the New dialog.
Cannot communicate with the instrument. Please check that it is connected, turned on, has the correct comm settings set in the properties, and that the port is not in use by another application.	Communications error, the software cannot communicate with the hardware. Please check the items indicated in the message.
The selected comm port is not connected to an APS 33xx. Select a different comm port from the properties dialog or close this file and select a different instrument type.	The selected comm port is connected to an instrument, but it is not the selected instrument type.
The file selected is not a valid data file.	The data file selected is not an Aerosol Instrument Manager data file.
The file selected does not contain any data records.	The data file is either empty or corrupt and cannot be opened by the Aerosol Instrument Manager software.
Access to <filename> was denied.	The file cannot be opened. Make sure it is not a Read Only file.
The file you have selected is part of a sequence of files. Do you want to view all the files?	You have selected a file that is part of a sequence of files. You can select **Yes** to view all the files or **No** to view only the file you initially selected.
Cannot find a file (<filename>) in the sequence of files associated with <filename>. Only the samples loaded will be available.	Warning to let you know that the sequence of files has a gap and the program cannot load all of the files.
Cannot find a file (<filename>) in the sequence of files associated with (<filename>). Only the samples loaded will be available.	One or more files in a file sequence cannot be found. The file(s) have either been moved or deleted.
Some samples have been marked for deletion. Do you want them permanently removed?	If you select **Yes**, the samples marked for deletion will be removed from the file. If you do not want the samples to be deleted, select **No**.
Density cannot be zero.	Data Settings page of the Properties dialog. The value for Density must be non-zero.
Stokes correction will not be applied when density is between 0.9 and 1.1.	Stokes correction will only be applied to the data if the value for density is outside of the range 0.9–1.1. The check box for stokes will be unchecked if the density is in the specified range.

Error Message	Description
Efficiency file does not exist.	Data Settings page of the Properties dialog. You entered an efficiency file that does not exist in the program directory. Check that you entered a valid filename and the file is in the program directory.
The dilution ratio has been set to 0. Check your efficiency file.	The value for dilution ratio in the efficiency file should not be 0. Edit the efficiency file to set the dilution ratio correctly.
User time field is empty!	Scheduling page of the Properties dialog. You selected User Defined from the scheduling tab of the properties box and did not enter a value. Enter a value or select another option on the scheduling tab.
The User Defined intersample time is less than the sample length.	Scheduling page of the Properties dialog. The Repeat rate must be > the Total Sample Time.
The Hours field cannot be blank.	Scheduling page of the Properties dialog.
The Minutes field cannot be blank.	Scheduling page of the Properties dialog.
The number of samples cannot be zero.	Scheduling page of the Properties dialog.
The sample length cannot be zero.	Scheduling page of the Properties dialog.
Upper channel boundary must be larger than lower channel boundary.	Format | View Boundaries dialog. You have selected a channel boundary for the upper channel that is lower than the channel boundary for the lower channel. You must select a channel boundary that is higher than the lower channel.
Log y scale is invalid because the minimum y scale value is set to 0.	Format | Y Axis dialog. You have tried to select log Y scale and you also have 0 as the fixed minimum value. You cannot have both selected. Change one.
Fixed Scale is selected. You must select a Minimum and/or Maximum value.	Format | Y Axis dialog. If you want to use the fixed scale parameter, you must select a minimum or maximum value.
Maximum value must be > minimum value.	Format | Y Axis dialog. You have entered a minimum value that is greater than the maximum value. Reenter the correct values.
You must enter a maximum value.	Format | Y Axis dialog. You must enter a maximum value to proceed.
You must enter a minimum value.	Format | Y Axis dialog. You must enter a minimum value to proceed.
0 is not valid for the maximum value.	Format | Y Axis dialog. You must enter a number greater than 0 to proceed.
0 is invalid when using a log y scale.	Format | Y Axis dialog. You must enter a number greater than 0 to proceed.

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